# MODEL EC127
# TEMPERATURE TEST CHAMBER
# USER MANUAL

Covers Model EC127 Environmental Chamber

The information in this document has been carefully checked and is believed to be entirely reliable. No responsibility, however, is assumed for inaccuracies. Further more, such information does not convey to the purchaser of the product described any license under the patent rights of SUN ELECTRONIC SYSTEMS, INC., or others.

Sun Systems strives constantly to improve the quality and performance of all of its products, in design, construction, and cost. As a consequence, SUN ELECTRONIC SYSTEMS, INC. reserves the right to change specifications, or other data contained herein, without notice.

Any software, firmware, designs, and any other programs in Sun Systems products remain the sole property of SUN ELECTRONIC SYSTEMS, INC. and may not be copied by any means. Purchase of said product constitutes agreement that software rights remain to the benefit of SUN ELECTRONIC SYSTEMS, INC.. Upon purchase, Sun Systems grants perpetual license for use by the customer.

Copyright NOVEMBER 1995 by SUN ELECTRONIC SYSTEMS, INC.

REV A

0112

**Sun Electronic Systems, Inc.** Tel: **321-383-9400** Email: **info@sunelectronics.com**

# Contents


**SECTION 1. GENERAL INFORMATION ..... 5**
- INTRODUCTION ..... 5
- LIMITED WARRANTY INFORMATION ..... 5
- EC127 DESCRIPTION ..... 6
- OPERATIONAL MODES ..... 6
- CHAMBER AND USER PROBES ..... 6
- FRONT PANEL OPERATION ..... 7
- REMOTE GPIB OR RS232/422 OPERATION ..... 7
- EC127 FRONT VIEW ..... 8
- EC127 REAR VIEW ..... 8
- EC127 INNER CHAMBER VIEW ..... 9
- EC127 INNER CHAMBER, AIR BAFFLE REMOVED ..... 9
- EC127 CONTROL SECTION SEPARATED ..... 10
- EC127 MAIN CONTROLLER AND SCANNER BOARDS ..... 11
- EC127 RIGHT SIDE PANEL REMOVED ..... 12
- EC127 REAR PANEL REMOVED ..... 13
- EC127 FRONT PANEL ..... 14

**SECTION 2. RECEIVING, SAFETY AND INSTALLATION ..... 15**
- INITIAL INSPECTION AND UNPACKING ..... 15
- LOST OR DAMAGED EQUIPMENT ..... 15
- SAFETY CONSIDERATIONS ..... 15
- EC127 CHAMBER INSTALLATION ..... 16
- INITIAL START UP ..... 16
- SETTING THE CHAMBER FAILSAFE ..... 17
- LOCAL PROGRAMMING EXAMPLE ..... 18

**SECTION 3. OPERATION AND COMMAND OVERVIEW ..... 23**
- COMMAND OVERVIEW ..... 23
- CONTROL PANEL OPERATORS ..... 23
- PARAMETER ENTRY ..... 24
- RS-232/422 SERIAL INTERFACE ..... 24
- RS232 CABLE WIRING DIAGRAM FOR EC127 ..... 25
- GPIB (IEEE-488) PARALLEL INTERFACE ..... 26
- POWER, HEAT AND COOL ENABLE ON/OFF CONTROL COMMANDS ..... 27
- COOL BOOST (LCO2 AND LN2) ..... 28
- TEMPERATURE CONTROL COMMANDS ..... 28
- TEMPERATURE SAFETY LIMIT COMMANDS ..... 29
- CONTROL LOOP PARAMETER COMMANDS ..... 29
- LOCAL PROGRAM COMMANDS ..... 30
- MODEL TC01/EC0X COMPATIBILITY COMMANDS ..... 31
- DEVICE I/O COMMANDS ..... 31
- SET DEFAULT MENU (SDEF) ..... 31
- SET INTERRUPT MENU (SINT) ..... 33
- REMOTE INTERRUPT CHARACTERS ..... 33
- PROBE CALIBRATION MENU ..... 34
- CAL TO A STANDARD ..... 35

**SECTION 4. INPUT/OUTPUT INTERFACES ..... 37**
- AUX ANALOG I/O INTERFACE ..... 37
- PROBE INTERFACE ..... 38
- CONNECTION DIAGRAM FOR PROBE/SENSOR ..... 38

**SECTION 5. DETAILED COMMAND DESCRIPTIONS ..... 39**
- BKPNT ..... 39
- BKPNTC ..... 40

BKPNT? ..... 40
C ..... 41
C1? ..... 41
C2? ..... 42
CALCN, CALAN, CALBN ..... 42
C1ON+, C1ON-, C1OFF+, C1OFF- ..... 43
C2ON-, C2OFF- ..... 43
COFF ..... 44
CON ..... 44
CSET1 ..... 45
DELL ..... 46
DELP ..... 46
DEVL1 ..... 47
EDIT ..... 48
END ..... 49
FOR/NEXT ..... 50
GOSUB ..... 51
HOFF ..... 52
HON ..... 52
I VARIABLES ..... 53
IN ..... 53
LIST ..... 54
LLO ..... 54
LOL1 ..... 55
LTL ..... 55
M ..... 56
OFF ..... 56
ON ..... 57
OUT ..... 57
PID1- ..... 59
PID1+ ..... 59
PIDA ..... 60
RATE1 ..... 60
RATE ..... 61
RTL ..... 62
RUN ..... 63
RUN-TIME OF DAY ..... 64
S/! ..... 65
SCALE1 ..... 66
SDEF ..... 67
SET1 ..... 68
SINT ..... 69
STATUS? ..... 70
STOP ..... 71
STOPE9 ..... 71
STORE ..... 72
T ..... 73
TEMP ..... 73
TIME ..... 74
TIMEE? ..... 74
UPL1 ..... 75
UTL ..... 75
VER? ..... 76
WAIT1 ..... 77
WAIT ..... 78
**SECTION 6. EC127 OPTIONS ..... 79**
POWER OPTIONS ..... 79

COOLING OPTIONS ..... 79
N2 GAS PURGE OPTION (NO NEEDLE VALVE) ..... 79
PORT AND WINDOW OPTIONS ..... 79
**SECTION 7. SPECIFICATIONS ..... 81**
**SECTION 8. MAINTENANCE ..... 83**
INNER CHAMBER AIR CIRCULATION EVAPORATOR CLEANING ..... 83
REFRIGERATION SYSTEM CONDENSER CLEANING ..... 83
**SECTION 9. CHAMBER REPAIR ..... 85**
TEMPERATURE CONTROLLER SECTION REMOVAL AND REPLACEMENT ..... 85
HEATER ELEMENT REMOVAL AND REPLACEMENT ..... 85
FAILSAFE THERMOSTAT REMOVAL AND REPLACEMENT ..... 86
REFRIGERATION SYSTEM CHARGING ..... 86
110 VAC 3 WIRE SCHEMATIC WITH VAC COOL VALVE ..... 87
110 VAC 3 WIRE SCHEMATIC WITH VDC COOL VALVE ..... 88
220 VAC 3 WIRE SCHEMATIC WITH VAC COOL VALVE ..... 89
220 VAC 3 WIRE SCHEMATIC WITH VDC COOL VALVE ..... 90
**SECTION 10. REPLACEMENT PARTS ..... 91**
**SECTION 11. ERROR MESSAGES ..... 93**

## SECTION 1. GENERAL INFORMATION

### INTRODUCTION

Congratulations on your purchase of the EC127 Environmental Chamber!! Your new chamber was manufactured under stringent quality control procedures to insure trouble free operation for many years of service. If you should encounter difficulties with the use or operation of your chamber, contact Sun Systems' "Customer Service Department" between the hours of 9:00 and 5:00 EST.

As with all Sun Systems products, we would appreciate any comments, suggestions or criticisms that you may have or develop regarding your evaluation of this equipment. Please address your comments to:

Sun Electronic Systems, Inc.
1845 Shepard Drive
Titusville, FL 32780
Tel: (321) 383-9400
Fax: (321) 383-9412
Website: www.sunelectronics.com
Email: info@sunelectronics.com

### LIMITED WARRANTY INFORMATION

SUN ELECTRONIC SYSTEMS, INC. WARRANTS THIS PRODUCT TO THE ORIGINAL PURCHASER TO BE FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP AND TO OPERATE WITHIN APPLICABLE SPECIFICATIONS FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF SHIPMENT, PROVIDED IT IS USED UNDER NORMAL OPERATING CONDITIONS. THIS WARRANTY DOES NOT APPLY TO SEALED ASSEMBLIES WHICH HAVE BEEN OPENED, OR TO ANY ITEM WHICH HAS BEEN REPAIRED OR ALTERED WITHOUT SUN SYSTEMS AUTHORIZATION.

RISK OF LOSS OR DAMAGE TO THE PRODUCT SHALL PASS TO THE CUSTOMER UPON DELIVERY, BY SUN SYSTEMS, TO THE CARRIER AT SUN SYSTEMS PREMISES.

WE WILL REPAIR OR, AT OUR OPTION, REPLACE AT NO CHARGE ANY OF OUR PRODUCTS WHICH IN SUN SYSTEMS JUDGMENT, ARE FOUND TO BE DEFECTIVE UNDER THE TERMS OF THIS WARRANTY. EXCEPT FOR SUCH REPAIR OR REPLACEMENT, SUN SYSTEMS WILL NOT BE LIABLE FOR ANY LOSS OR DAMAGE TO PERSONS OR PROPERTY CAUSED EITHER DIRECTLY OR INDIRECTLY BY USE OF THIS PRODUCT OR FOR ANY INCIDENTAL DAMAGES OR FOR ANY CONSEQUENTIAL DAMAGES. BEFORE USING, PURCHASER SHALL DETERMINE THE SUITABILITY OF THIS PRODUCT VIA THIS DOCUMENT FOR HIS INTENDED USE AND PURCHASER ASSUMES ALL RISK AND LIABILITY WHATSOEVER IN CONNECTION THEREWITH. NO STATEMENT OR RECOMMENDATION NOT CONTAINED HEREIN SHALL HAVE ANY FORCE OR EFFECT UNLESS IN AGREEMENT SIGNED BY AN OFFICER OF SUN ELECTRONIC SYSTEMS, INC.

## EC127 DESCRIPTION

The Model EC127 subjects objects placed in the chamber area to either heated or cooled air which circulates from the intake in the rear of the test chamber area, up and across the roof of the test chamber, inside a baffle, and vertically downwards back into the test chamber area. Inside the test chamber area baffle, resistance heaters heat the circulating air and the refrigeration systems evaporator cools the air. The controller in the Model EC127 automatically maintains the desired temperature and rate of change of temperature in the chamber test area. The controller uses Proportional, Integral and Derivative (PID) control techniques. If necessary, you may tailor the characteristics of the PID algorithms independently for both heat and cool. The Model EC127 is instructed to control temperature either by issuing single segment control commands or by writing and executing local control programs which are stored in the controllers battery backed RAM. Single commands and programs may be issued from either the local control panel located on the front of the chamber or remotely from either the RS-232/422 serial interface or the GPIB interface.

## OPERATIONAL MODES

Temperature testing usually involves testing an object at one or several different temperatures. In the case of more than one temperature, the rate of change from one temperature to another and the time waiting at a particular temperature are considerations. In the single temperature mode, the Model EC127 accepts single commands defining an individual temperature segment containing rate of change from the present temperature to the final temperature, wait time at the final temperature and final temperature setpoint information. At the end of a wait period, notification is given to the source of the command. If multiple temperature segments are to be performed by the Model EC127 automatically, the Model EC127 can be programmed by entering the EDIT mode and the program can then be executed by entering the RUN mode. The Model EC127 stores up to 10 programs into battery backed memory. The number of temperature segments resident in each program is only limited by the Model EC127's controller internal memory space. Programs can also call other programs as subroutines.

The Model EC127 contains setup modes which are menu driven on the controllers front panel. The CAL mode permits selection of temperature scale, probe type, and probe calibration for both the chamber and USER probes. The SDEF mode permits modification of default parameters such as GPIB address, D/A output configurations, alarm function and buzzer loudness, etc. The SINT mode permits modification of interrupt configuration parameters such as GPIB SRQ functions.

## CHAMBER AND USER PROBES

The EC127 has two measurement probes located in the chamber. The chamber probe is hidden from view behind the top air baffle. It measures the air temperature just before the air exits the plenum and flows into the work space. The chamber probe is normally the control probe unless a special control mode is selected. The USER probe is accessible within the test chamber area. The user probe is provided for whatever need you may have. Some common uses are to measure or control the actual temperature of a sample under test or to measure or control air temperature near

the sample. The USER probe is electrically isolated from other chamber electronics permitting the probe to be directly attached to devices containing voltages up to 240 volts relative to chamber earth ground. In the CAL menu the type of probe used can be changed, but the default user probe type is a K thermocouple. The chamber and user probes values are displayed on the chamber control panel and may be read remotely by a host computer.

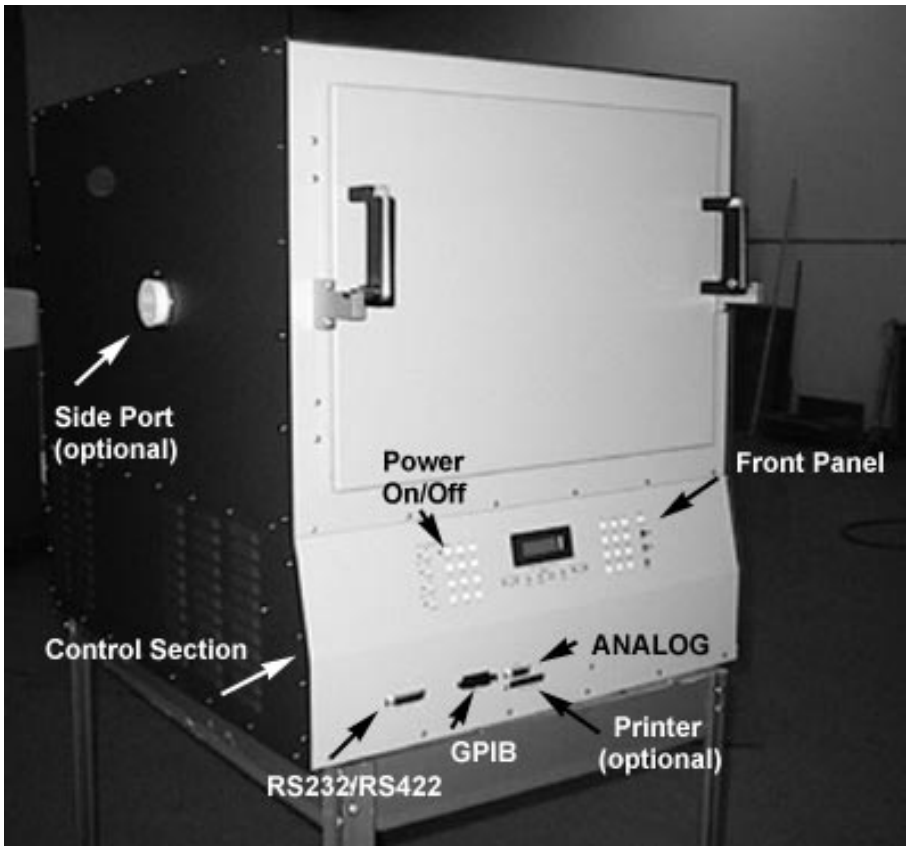
## FRONT PANEL OPERATION

The Model EC127 can operate in a stand alone configuration through the use of its control panel located on the front of the unit. The keyboard contains keys for numerical data, commands, program instructions and menu control. Some of the keys perform more than one function. The alternate key functions are printed in green or red. To access the alternate key function the corresponding color shift key is used. During command entry, the second LCD line displays the entries as they are keyed in. The entry may be edited using the green shift backup or green shift cancel keys prior to entering the command via the enter key. In addition to the 2 line LCD display, a buzzer and LED indicators provide positive indication of system function. Key functions not required to run the EC127 are defeated automatically by the controller software.

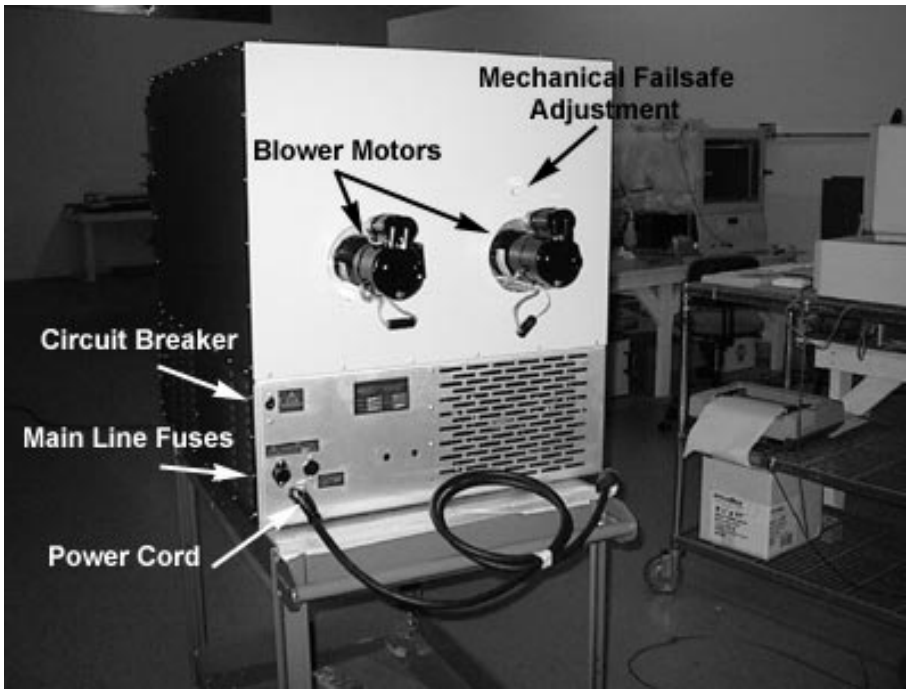
## REMOTE GPIB OR RS232/422 OPERATION

The Model EC127 can be operated remotely, from a host computer, via the built in IEEE-488 standard [ GPIB ] interface or either the RS-232 or RS-422 serial interfaces. Individual commands may be sent to the Model EC127 or programs may be down loaded and executed, further relieving the host computer. Section 3 provides detailed information on programming commands.

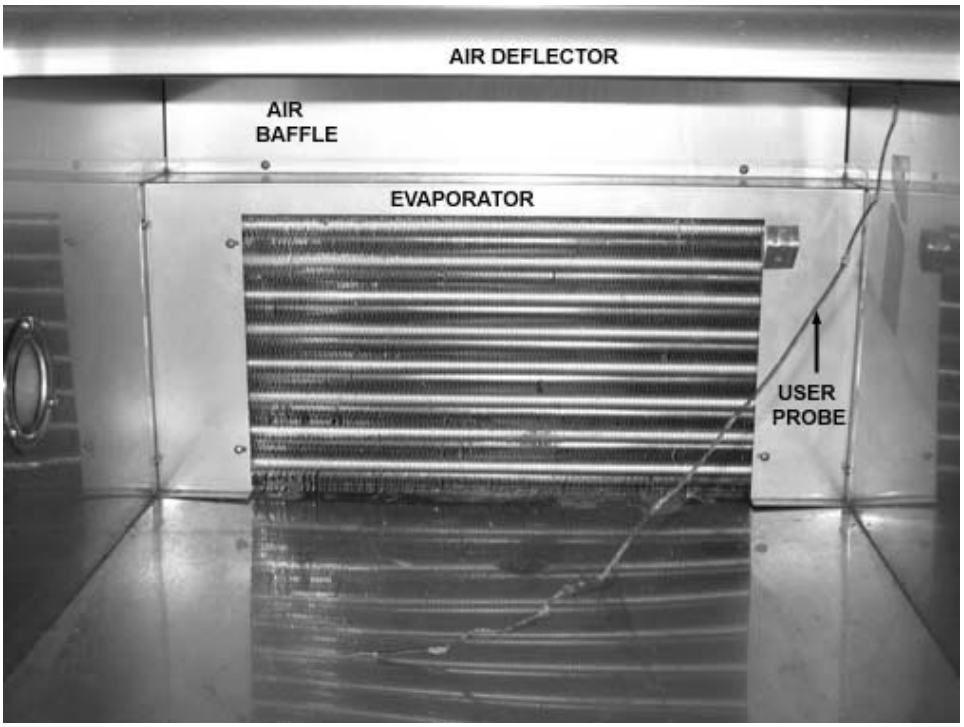
## EC127 FRONT VIEW



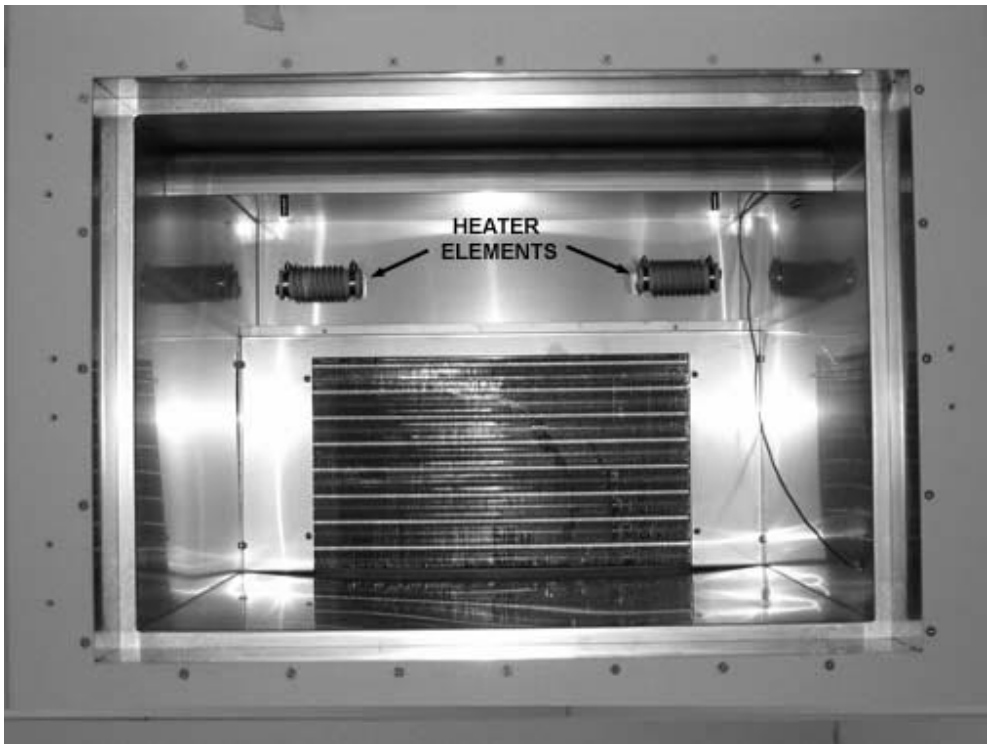

## EC127 REAR VIEW



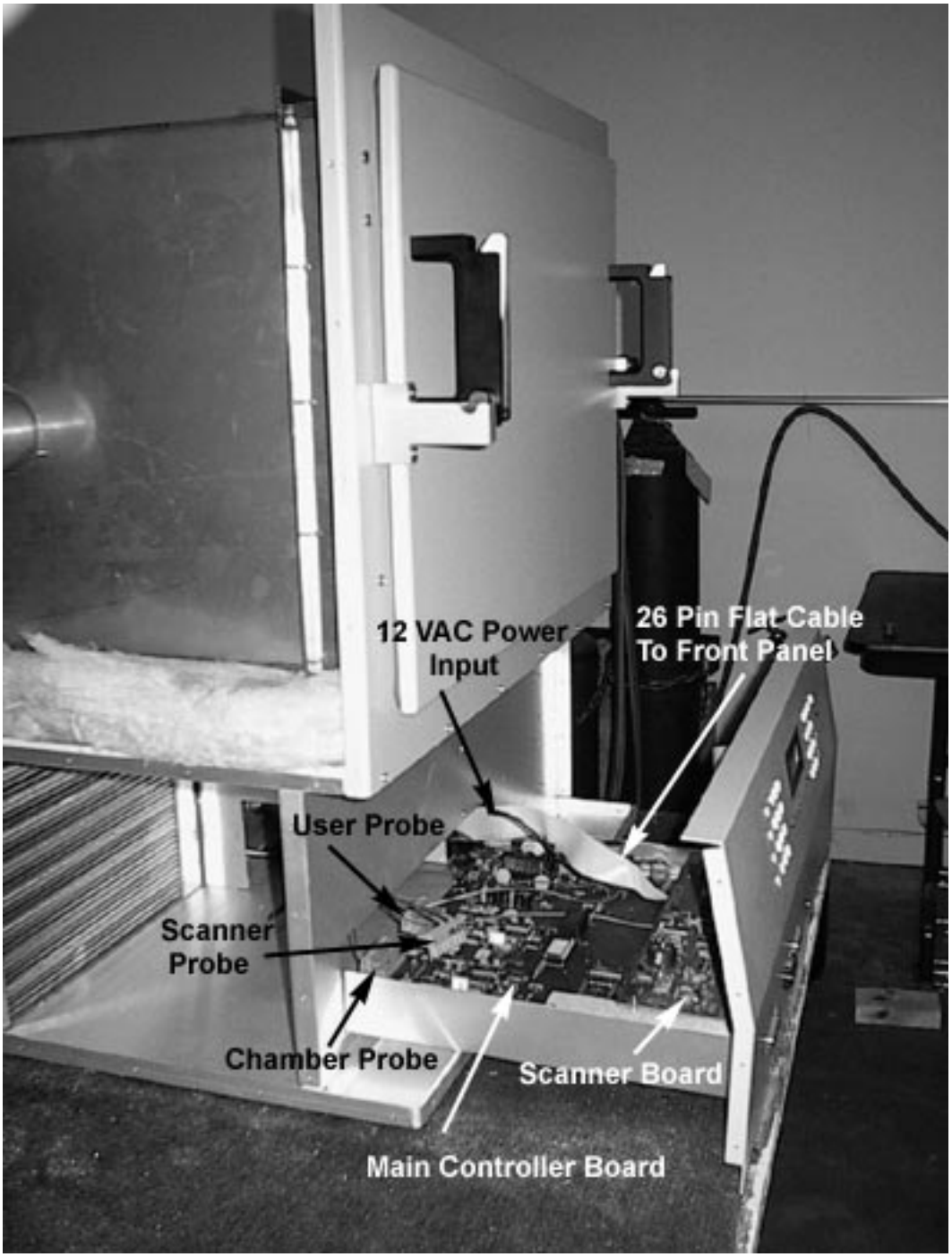
## EC127 INNER CHAMBER VIEW



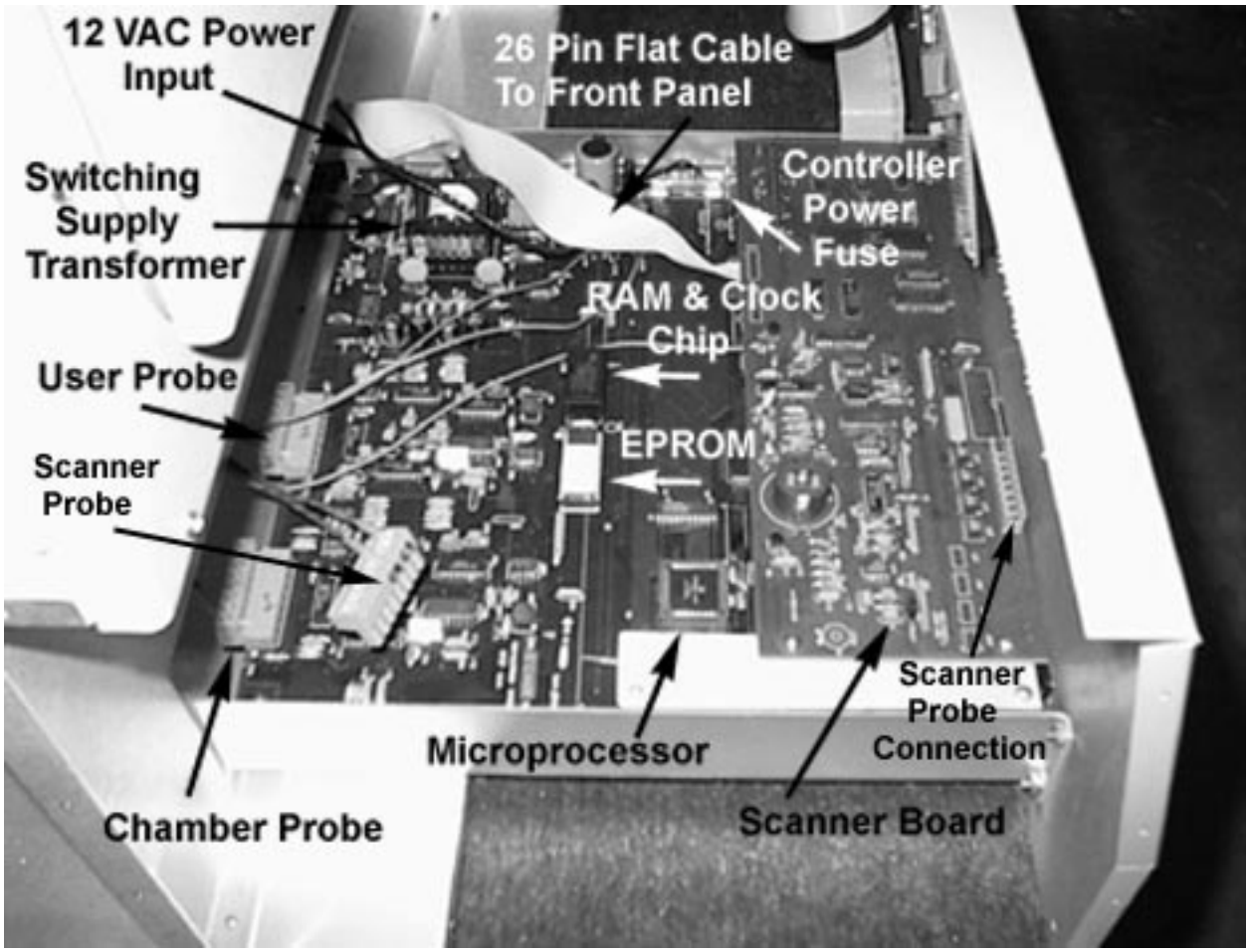

## EC127 INNER CHAMBER, AIR BAFFLE REMOVED



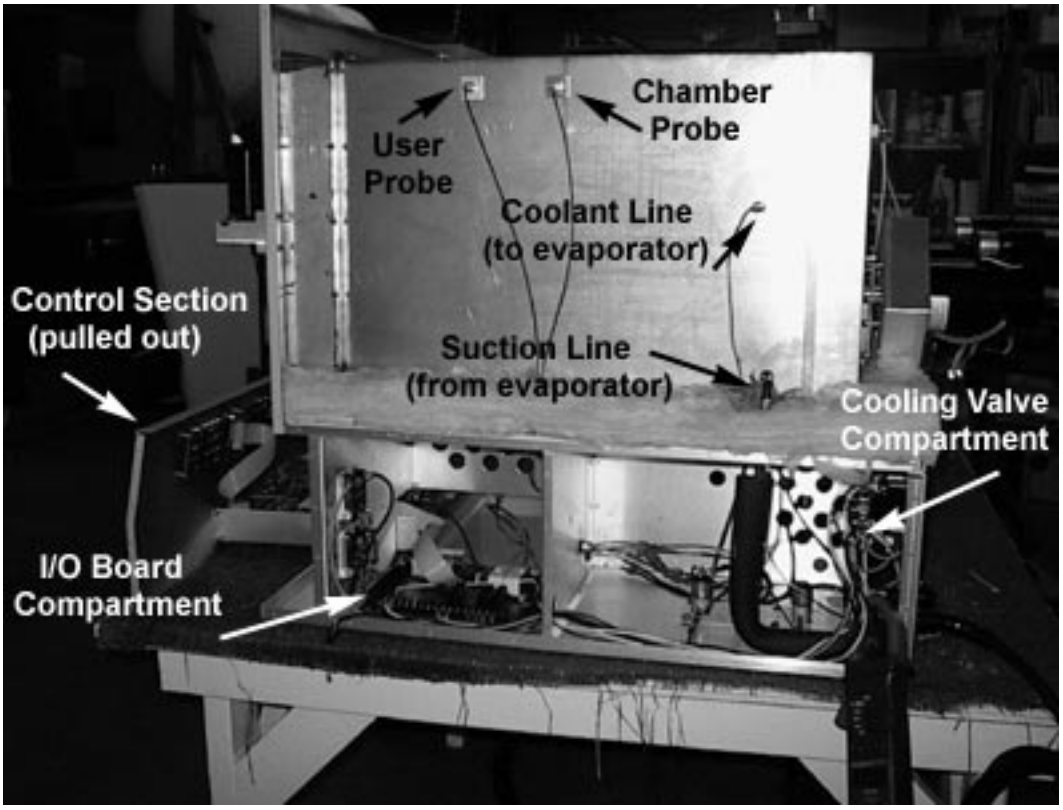
**EC127 CONTROL SECTION SEPARATED**
(LEFT SIDE PANEL REMOVED)



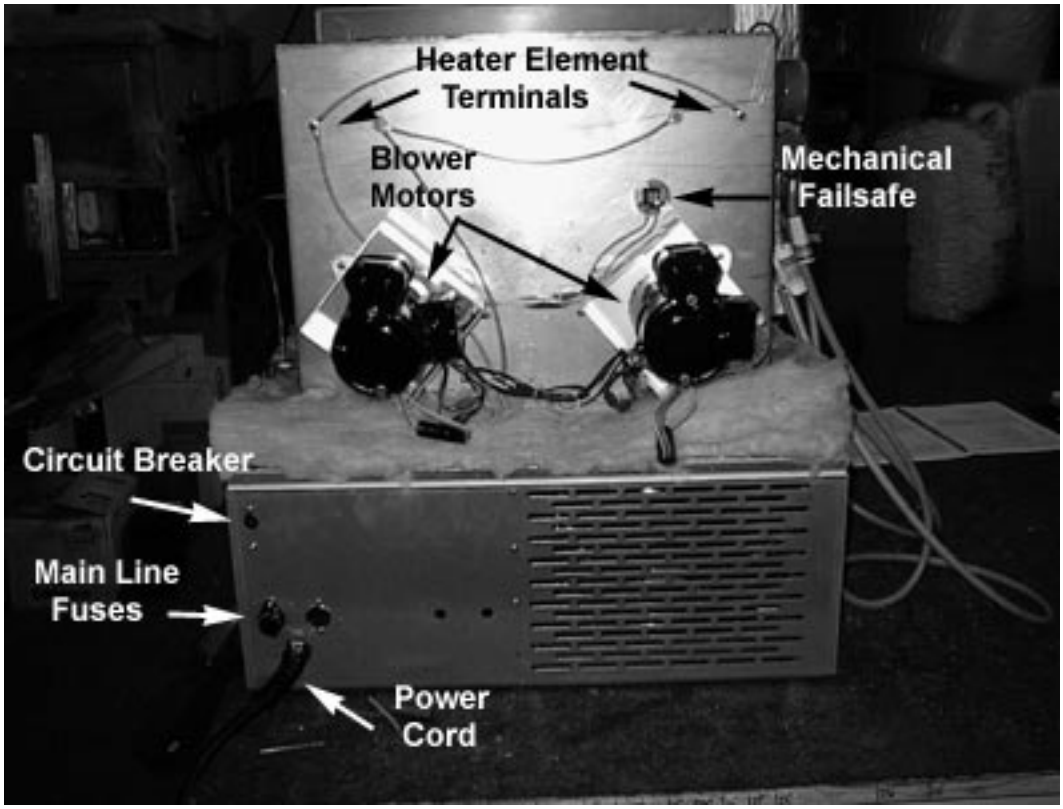
## EC127 MAIN CONTROLLER AND SCANNER BOARDS



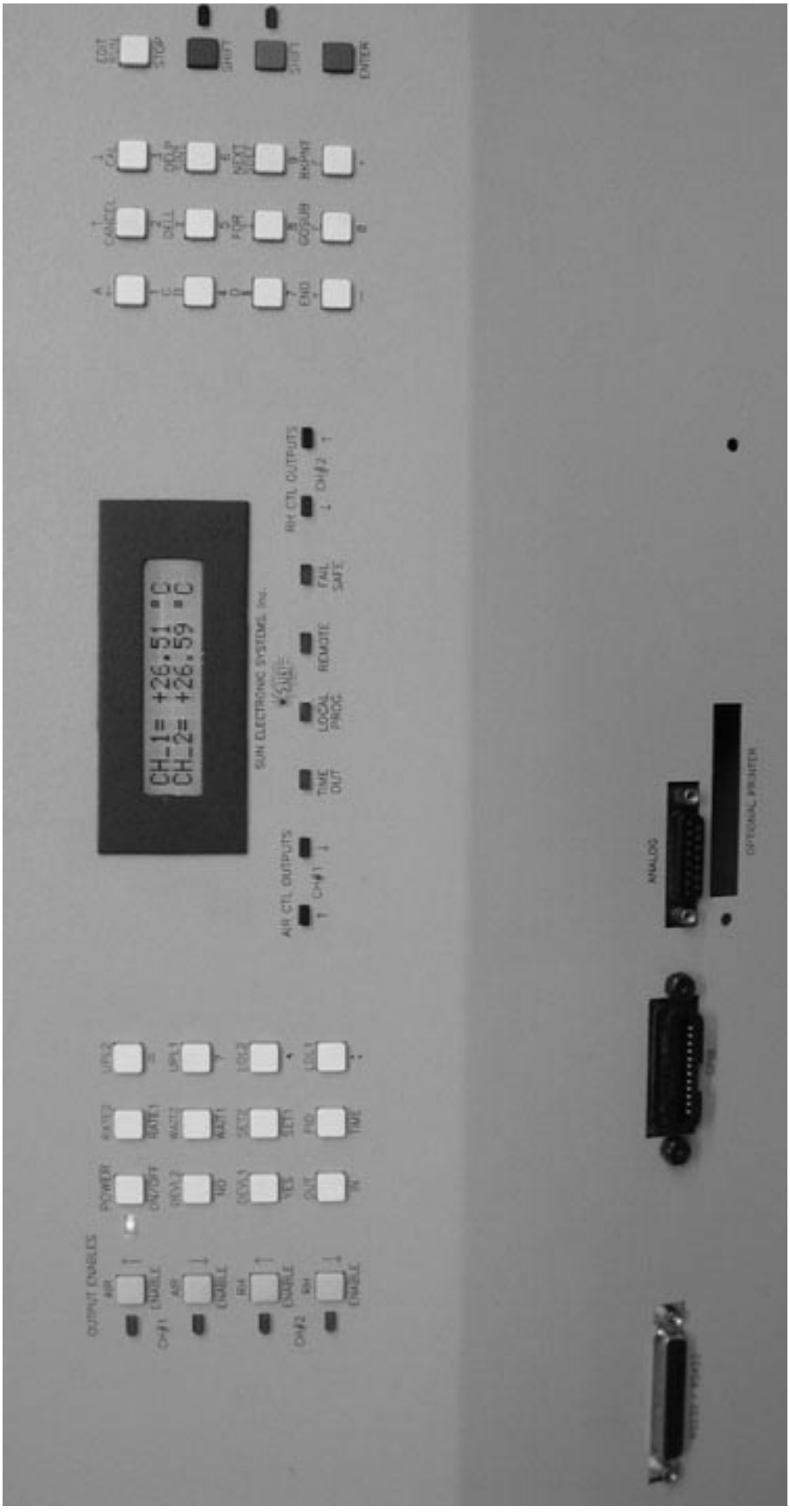
## EC127 RIGHT SIDE PANEL REMOVED



## EC127 REAR PANEL REMOVED



## EC127 FRONT PANEL



## SECTION 2. RECEIVING, SAFETY AND INSTALLATION

### INITIAL INSPECTION AND UNPACKING

Inspect the shipping container for obvious damage. If the shipping container is damaged, then a written note on the bill of landing describing the damage should be made while the delivery person is still on the premises. Unpack the EC127 and save all packing material in case the unit needs to be returned. Verify the contents of the carton matches that of the items listed on the packing slip.

### LOST OR DAMAGED EQUIPMENT

If you determine that the goods described on the packing slip are lost or damaged, first notify the transportation company to obtain the correct procedure for returning merchandise for repair or replacement. Then call Sun Systems for a return authorization number so that we may best handle the merchandise when it is returned.

### SAFETY CONSIDERATIONS

Please take a moment to read the following safety precautions. If, for any reason, you do not fully understand the meaning of the cautions, contact Sun Systems customer service before proceeding.

CAUTION - Before placing the chamber into normal service set the bimetal fail-safe sensor. This will be covered in detail shortly.

CAUTION - Disconnect all electrical power sources before attempting any type of access or service to the chamber to prevent electrical shock.

CAUTION - Always operate the chamber with the case grounded to earth ground. The ground pin on the line cord is wired to the chamber case. Do not defeat its purpose. Verify that the power outlet to be used has an earth ground and meets your local electrical codes.

CAUTION - Verify that the source of electrical power is compatible with the manufactured configuration of the chamber indicated on the rear of the unit. Check both voltage and current rating of your line outlet.

CAUTION - Avoid personal contact with the interior portions of the test chamber area to prevent burns from heat or cold.

CAUTION - Operate the chamber in a cool well ventilated area. The refrigeration system requires unobstructed air flow around the chamber for cooling.

CAUTION - Do not block the internal chamber air circulation. Air is pulled in over the evaporator coil located on the rear wall of the inner chamber. Be careful when placing your test specimen so as not to block airflow. Reduced airflow may cause heater element failure.

CAUTION - Keep the unit in an upright position at all times. The refrigeration compressor contains oil which requires a level orientation of the unit.

CAUTION - When operating the chamber at low temperatures for extended periods of time, operate the chamber at 100°C for an hour to dry any moisture which may accumulate in the fiberglass insulation material surrounding the test area of the chamber.

## EC127 CHAMBER INSTALLATION

The EC127 is factory wired for AC sources delivering 110, 208 or 240 VAC, 50/60 Hz. A tag located on the back panel of the chamber indicates the proper voltage to be applied. Insure that the current rating of the service is sufficient to provide the necessary amounts of power required by the chamber. For the 110 vac version you will need a full 15 AMP service therefore you must make sure that the chamber is the only load on a 15 AMP branch. For the 208 and 240 versions 10 AMPS is required. Install the chamber on a surface which is flat, rigid and free from dust, shock and vibration. Orient the chamber in such a manner that at least 18 inches of free air space exists around the rear and sides of the chamber to provide cooling for the compressor system.

Once all packing material has been removed ( check inside the inner chamber also ) and it is plugged into the power line, the Model EC127 is ready for operation. Press the white power key located on the front panel. After self check is complete the Model EC127 should power up with the LCD display indicating chamber probe temperature and USER probe temperature. The blowers located in the rear of unit should be operating. The unit is now ready to accept commands.

## INITIAL START UP

To get acquainted with the chamber front panel operation we will set a single temperature control segment. A segment consists of three parameters. The RATE of change of temperature in degrees per minute determines how fast you want the temperature to move. Second the WAIT time or amount of time you wish to stay at a new temperature. Thirdly the SET temperature you wish to go to.

{To set a single temperature segment}

1. First enable the heat and cool outputs, press the yellow CH#1 Air Enable (up arrow) for heat and CH#1 Air Enable (down arrow) for cool.

2. Set the rate of change of temperature to 2 deg / min.

RATE1
=

2

blue ENTER

3. Next set the wait time to 1 minute and 10 sec

WAIT1

=

0

:

1

:

1

0

blue ENTER

4. Set the target temperature to 40 degrees

SET1

=

4

0

blue ENTER

Enable the heat and cool outputs, press the yellow CH#1 Air Enable (up arrow) for heat and CH#1 Air Enable (down arrow) for cool. The LED's are on when enabled. The chamber will ramp to 40 deg and after being at the set temperature for 1 minute and 10 sec, it will time out. Time out is indicated via the buzzer and/or the LED on the front panel. In this single temperature setting mode the controller will continue to hold the SET temperature until instructed to go to another SET point. The RATE setting will stay in effect until changed by another RATE command, so if the RATE is going to be the same it is not necessary to enter it again. If the time-out buzzer feature is not needed it is also not necessary to enter a WAIT command. Thus in the simplest case the only command needed is the SET=<number> command when running in the single temperature set mode.

## SETTING THE CHAMBER FAILSAFE

The EC127 chamber has a redundant, independent to the electronic controller, latching over temperature protection circuit. The redundant circuit consists of a bimetal adjustable temperature sensor and a remote trigger coil in the chambers power line breaker. When the temperature in the chamber exceeds the bimetal sensor setting, its contacts close and thus cause the rear panel breaker

to trip off. When the breaker trips, power is removed from the heating circuit, compressor and bimetal fail-safe sensor circuit. The FAILSAFE LED on the front panel will light to indicate the FAILSAFE lockout state. Power to the electronic controller is not removed however it is locked out of operation until the rear breaker is reset.

The factory preset for the mechanical fail-safe thermostat is 200C. You can adjust the fail-safe from slightly above room temperature to the 205 deg C chamber limit. To adjust the fail-safe setting to another temperature, perform the following procedure. If you are unfamiliar with the operation of the chamber or if the 200 deg centigrade upper limit is OK for now then come back to this section later to set the fail-safe temperature. Be sure to set the fail-safe before placing the chamber into normal service since shipping vibration may have changed the factory setting.

STEP 1 - Locate the fail-safe adjusting hole on the rear of the EC127 and displace any insulation material which may block access to the fail-safe adjusting screw.

STEP 2 - Set the chamber temperature to the desired fail-safe temperature and let the chamber soak for a period of 20 minutes. If the fail-safe trips during heat up, then turn the bimetal sensor adjusting screw counter clockwise 1 turn then lift the breaker lever to reset it.

STEP 3 - After the chamber has been at temperature for 20 minutes, slowly turn the adjustment screw clockwise to lower the fail-safe trip point until the circuit breaker on the rear of the unit trips. Then adjust the fail-safe back 1/4 of a turn counter clockwise and reset the circuit breaker to restore normal operation.

## LOCAL PROGRAMMING EXAMPLE

The following program demonstrates some of the most used local programming features. The program will cause the chamber to go to 50 deg at a rate of 3 deg / minute and stay there for 5 minutes. After the 5 minutes at 50 deg the buzzer will buzz and BKPNT 1 will be displayed. To continue from the breakpoint press ENTER . The chamber will then go to 0 deg, at a rate of 2 deg / minute and stay there for 7 and one half minutes. Then BKPNT 2 will be executed, press enter to continue. Then the above will be repeated 5 times by the FOR - NEXT loop. To enter the program in program #0 perform the following key strokes.

red SHIFT ;to delete existing prog #0 (if any)

DELP

0

blue ENTER

red SHIFT ;to create a program

EDIT

0

blue ENTER ; free memory is displayed, then line #1
is displayed , if program is empty then
END is displayed

NOTE: While in edit mode, red up and down arrow keys allow you to move in the local program. The red DELL allows you to delete the current displayed program line. A line can be inserted in front of the current displayed program line by entering the new line.

red SHIFT

FOR

0

=

1

,

6

blue ENTER

RATE1

=

3

ENTER

WAIT1

=

5

ENTER

SET1

=

5

0

ENTER

red SHIFT

BKPNT

1

ENTER

RATE1

=

2

ENTER

WAIT1

=

0

:

7

:

3

0

ENTER

SET1

=

0

ENTER

red SHIFT

BKPNT

2

ENTER

red SHIFT

NEXT

0

ENTER

red SHIFT

END

ENTER ; local edit now done

To run the program, green SHIFT ,RUN, 0, ENTER

## SECTION 3. OPERATION AND COMMAND OVERVIEW

The Model EC127 is very adaptable to your test system requirements. Whether issuing commands from the local front panel keyboard or remotely from the IEEE-488 GPIB or RS-232/422 serial interface, you have full control of all the Model EC127 capabilities. This chapter starts off with a command overview section to assist users who are new to the operation of the chamber followed by sections which define in detail the operation of the Default, Interrupt and Calibrate Menus. Setting of the mechanical fail-safe was covered in section 2. Section 5 contains an alphabetically sorted detailed description for all commands, which is to be used as a detailed programming reference.

### COMMAND OVERVIEW

This section groups the various commands available for the Model EC127 by function and gives a brief definition for the command. Consult Section 5 for a detailed definition on a particular command.

Commands from the local control panel described in the following sections may require several keystrokes followed by depressing the ENTER key. Commands from the GPIB interface are terminated with the EOI and/or a line feed character. Command lines from the RS-232/422 interface may be terminated with a line feed or carriage return character or both carriage return and line feed characters. Numeric values with leading and trailing zeros and spaces are accepted and integer, fixed and floating point values are converted as required. Commands are not case sensitive.

If an error is made during command entry, either locally or remotely, a COMMAND ERROR message is displayed. To determine the cause of the error, you may press the [?] Key followed by the [ENTER] Key from the local keyboard or enter ? from a remote interface. The controller will provide a 2 line response. The first line will be a copy of the last command received. The second line will be either a pointer to the error, or an explanation of the error. If there was no error in the last command received, the controller will respond with a two line "OK" "OK" message.

### CONTROL PANEL OPERATORS

To permit easy command entry and local program generation, the following operators on the local control panel permit command entry, command cancellation, menu decisions, single command line editing during STOP mode and program editing during EDIT mode.

| | |
|---|---|
| UP, DOWN ARROWS | ;Line editing during Local Program editing. |
| DELL | ;Delete current program line |
| DELP n | ;Delete local program number n |
| LEFT ARROW | ;Character backspace during command entry. |
| CANCEL | ;Cancels present command entry. |

ENTER ;Enters command into Model EC127 controller.
;Or inserts a line into the local program in edit.

YES, NO ;Operators for SDEF, SINT and CAL menu's.

## PARAMETER ENTRY

Parameters are used for numeric data entry, delimiters and function operators in command lines.

0-9 .+- Numeric data (depicted as nnn.n in following sections)

. : , Numeric delimiters.

e or E Exponent for scientific notation.

= Set variable left side equal to value on right side.

? Examine variable left side .

## RS-232/422 SERIAL INTERFACE

The EC127 provides for RS232 or RS422 remote control. The primary difference between RS232 and RS422 is the type of line drivers and receivers used. RS232 is the most common of the two serial interfaces used today.

The serial port's operation depends on whether CMD ERROR INT'S are enable or disabled in the SINT menu. If command error interrupts are disabled, no indication to the host computer communicating to the serial interface is given as to whether a command was accepted or rejected. To determine last command status the ? command may be used. If command error interrupts are enabled, the controller responds with a CMD ERROR!! message if the command received was rejected. If the command was accepted and the type of command does not invoke a reply, i.e., such as a SET=nnn.n command, the controller will reply with an OK message. If the accepted command invokes a reply, then the reply is sent without the OK message. The CMD ERROR INT ENABLED mode is convenient since every command sent to the controller generates a reply back to the host computer thereby providing a handshake.

The RS port operating parameters are set up in the SDEF menu. The SDEF menu allows setting of the BAUD RATE, RS232 or RS422 levels, ECHO on / off, and whether to use hardware handshake. The serial port sends a zero for the parity bit and does not check incoming parity. When DTR/CTS is not selected only the TRAN DATA, REC DATA and GROUND signal lines are significant to the controller. To communicate over the RS232 bus, a cable constructed with a male DB25 connector on EC127 controller end and a female DB9 connector on PC end and wired as follows is required:

**RS232 CABLE WIRING DIAGRAM FOR EC127**

| EC127 (DB25 Male) Pin# | | COMPUTER (DB9 Female) Pin# |
|---|---|---|
| (2) TxD | ——————— | RxD (2) |
| (3) RxD | ——————— | TxD (3) |
| (7) GND | ——————— | GND(5) |

To communicate through Windows HyperTerminal, use the following settings:

Connect using desired COM Port
Bits per second: 9600 (default setting in EC127 SDEF Menu)
Data bits: 8
Parity: NONE
Stop bits: 1
Flow control: NONE

If your computer is using a DB25 Male connector instead of the DB9, the wiring connections are as follows. For example purposes this diagram also assumes DTR/CTS control is selected.

| EC127 CONTROLLER (DB25 Male) | | COMPUTER (DB25 Female) |
|---|---|---|
| (2)TxD | _____ | RxD (3) |
| (3) RxD | _____ | TxD (2) |
| (5) CTS | _____ | DTR (20) |
| | \|____ | DCD (8) |
| | \|____ | DSR (6) |
| (20) DTR | _____ | CTS (5) |
| (7) GND | _____ | GND (7) |

** NOTE: CTS & DTR are Optional. If enabled in SDEF Menu but not hardwired, unit will not communicate.

The EC127 chamber provides RS422 serial interface signals on the 25 pin connector in addition to the RS232 signals. The 25 pin connector signals are:

| | |
|---|---|
| 1,7,13,15,17 | GROUND |
| 2 | TXD RS232 TRANSMIT DATA |
| 3 | RXD RS232 RECEIVE DATA |
| 5 | CTS RS232 CLEAR TO SEND |
| 20 | DTR RS232 DATA TERM READY |
| 12 | +TXD RS422 TRAN DATA + |
| 25 | -TXD RS422 TRAN DATA - |
| 10 | +RXD RS422 REC DATA + |
| 23 | -RXD RS422 REC DATA - |
| 9 | +CTS RS422 CTS+ |
| 22 | -CTS RS422 CTS- |
| 11 | +DTR RS422 DTR+ |
| 24 | -DTR RS422 DTR- |

When enabled the following ASCII interrupt characters are sent out over the serial port. The interrupt character is followed by a carriage return, line feed. Interrupts will not be sent during a normal transfer of data.

| | |
|---|---|
| SINGLE TEMPERATURE TIME OUT | I |
| COMMAND ERROR | CMD ERROR! |
| LP TIME-OUT | P |
| LP DONE | E |
| DEVIATION LIMIT | D |
| UPL1 EXCEEDED | O |
| LOL1 EXCEEDED | U |
| POWER GOING DOWN | ! |
| POWER UP NO AUTO CONTINUE | Z |
| POWER UP AUTO CONTINUE | X |
| BREAK POINT | B |

## GPIB (IEEE-488) PARALLEL INTERFACE

The EC127 chamber incorporates a IEEE-488 standard interface for communication with a host controller. The GPIB interface supports TALK, LISTEN, SPOL serial poll and PPOL parallel polling. When CMD ERROR INT'S are enabled via SINT menu, the GPIB port sends a CMD ERROR SRQ interrupt on commands received with errors. If command error interrupts are disabled, then no response is sent to the GPIB port if command errors are detected. In all cases, the only data that is sent to the GPIB interface by the controller is that which is requested by a command received by the controller. The GPIB port does not respond with "OK" after commands, that do not send back data, since handshaking is a inherent bus feature. Last command status can be determined through the use of the ? command or the STATUS? command if polling is preferred over interrupts.

The SDEF menu allows you to set the GPIB address, and the GPIB LOCKUP TIME, which is the length of time that the controller will wait for the host to accept data before generating a GPIB LOCKUP interrupt. The SINT menu also provides the ability to set up the parallel poll bit.

The bus signal pin assignments are as follows.

| PIN # | SIGNAL | PIN # | SIGNAL |
|---|---|---|---|
| 1 | DIO1 | 13 | DIO5 |
| 2 | DIO2 | 14 | DIO6 |
| 3 | DIO3 | 15 | DIO7 |
| 4 | DIO4 | 16 | DIO8 |
| 5 | EOI | 17 | REN |
| 6 | DAV | 18 | GND |
| 7 | NRFD | 19 | GND |
| 8 | NDAC | 20 | GND |
| 9 | IFC | 21 | GND |
| 10 | SRQ | 22 | GND |
| 11 | ATN | 23 | GND |
| 12 | SHIELD | 24 | GND LOGIC |

The EC127 recognizes a line feed with or without EOI set, or EOI set during the last character as an input line terminator. The controller, when talking, will send a line feed with EOI set as the line terminator. The chamber will pull the SRQ line low if it needs to send an interrupt. If the host computer does not perform a serial poll before another interrupt is generated then the EC127 will display SRQ OVERFLOW on the front panel. This message is to inform the user that interrupts have not been read by the host computer. The message can be ignored if you do not wish to provide an interrupt handler in your host software. Also by disabling interrupts in the SINT menu, or via the SINT= command, the interrupts may be turned off. The parallel poll bit, as set in the SINT menu, can be used to increase interrupt service speed when there are a number of interrupting devices on the GPIB bus.

The following interrupt values are sent to the GPIB port. Many of the interrupts may be disabled via the SINT menu. IEEE-488 interrupt values are the value received when a serial poll is conducted.

| CONDITION | HEX | DECIMAL |
|---|---|---|
| NO INTERRUPT | $00 | 0 |
| SINGLE TIME OUT | $41 | 65 |
| COMMAND ERROR | $42 | 66 |
| LP TIME-OUT | $43 | 67 |
| LP DONE | $45 | 69 |
| DEVIATION INT | $46 | 70 |
| UPL1 EXCEEDED | $47 | 71 |
| LOL1 EXCEEDED | $4A | 74 |
| GPIB LOCKUP | $4F | 79 |
| BKPNT | $50 | 80 |

## POWER, HEAT AND COOL ENABLE ON/OFF CONTROL COMMANDS

These commands turn the Model EC127 main power on/off and enable or disable the heat and cool functions. On the Model EC127 control panel, these functions have separate function keys. The switches operate in a push-on/push-off or alternate action fashion. The indicator is on when the function is enabled. The following commands are for remote operation only. When the Model EC127 main power is OFF and the unit is plugged in, the controller will only accept the ON command from a remote interface.

ON Turn Model EC127 main power on.
OFF Turn Model EC127 main power off.
C1ON+ Enable air heat function.
C1OFF+ Disable air heat Function.
C1ON- Enable air cool function.
C1OFF- Disable air cool function

## COOL BOOST (LCO2 AND LN2)

Note: This feature is only operational when the chamber has been ordered with the optional LCO2 or LN2 Cool Boost.

To enable cool boost from local front panel;
Press yellow Channel#2 down enable key. LED will come on signifying that boost is enabled. Press key again to disable boost. LED will go off.

To enable cool boost remotely;
Send C2ON - to enable cool boost. Send C2OFF - to disable cool boost.

To enable or disable cool boost in a local program;
When in edit mode and at location in program where you wish to enable or disable cool boost, press the Channel#2 down enable key. Press enter if it is the function you want. If you get the wrong function (i.e., C2OFF, when you want C2ON) press green shift CANCEL to delete that line and press enable key again to get correct enable/disable function. Press enter to store it in the local program.

## TEMPERATURE CONTROL COMMANDS

Temperature control commands allow you to set or examine temperature segment parameters. A temperature segment in the Model EC127 is defined by the rate of change of temperature (RATE) from the present chamber temperature to the final temperature (SET) and by the amount of time to wait (WAIT) at the final temperature before continuing with the next temperature segment or providing time out indication. Upon detection of a SET command, the controller uses the values as given by the RATE and WAIT commands and initiates the proper action to implement the next temperature segment. For best operation enter the RATE and WAIT information before entering the SET point. The CSET? command allows you to examine the current temperature which the controller is attempting to control to during ramps from one temperature to another. This value changes at the rate defined by the RATE command until the SET value is reached. At that point CSET is equal to the SET value. The chamber and user temperature may be read remotely at any time and are displayed on the LCD display.

| | |
|---|---|
| SET1=nnn.n | Set segment final temperature. |
| SET1? | Examine present segment final temperature. |
| WAIT1=nn:nn:nn | Set temperature soak period at final temperature (HRS:MIN:SEC) |
| WAIT1=nn | set wait time (MIN) |
| WAIT1=F{OREVER} | Wait Period never times out. |
| WAIT1? | Examine present wait period. |
| RATE1=nnn.nn | Set temperature ramping rate at nnn.nn degrees per minute |
| RATE1? | Examine present temperature ramping rate. |
| CSET1? | Examine present temperature of which controller is attempting to control. |
| C2? | Examine USER probe value. |
| C1? | Examine CHAMBER probe value. |
| SCALE#1? | Examine Units of Scale for the Chamber Probe; C, \F, or K. |
| SCALE#2? | Examine Units of Scale for the USER Probe; C, F, or K. |

| | |
|---|---|
| TIME=hh:mm:ss | Set Time of Day |
| TIME? | Examine present Time of Day |
| STOP | Prematurely terminate the run mode or make set=none if run mode not active |

## TEMPERATURE SAFETY LIMIT COMMANDS

Temperature limit commands are used for safety reasons and to insure test parameters are not exceeded. Lower and upper temperature limits prevent setting temperatures in violation of the limit setting. In addition, upper and lower temperature limit commands shall generate an interrupt to the active remote device if the chamber exceed one of the temperature limits. If the chamber temperature exceeds the upper temperature limit, the controller will automatically turn off chamber heating. If the chamber temperature exceeds the lower temperature limit, the controller will automatically turn off chamber cooling. The deviation limit generates an interrupt to the remote interface, if enabled in the SINT menu, if the chamber temperature exceeds the tolerance you specified via DEVL command.

| | |
|---|---|
| LOL1=nnn.n | Set chamber lower temperature limit. |
| LOL1? | Examine lower temperature limit |
| UPL1=nnn.n | Set chamber upper temperature limit. |
| UPL1? | Examine upper temperature limit. |
| DEVL1=nnn.n | Sets maximum +/- chamber temperature deviation limit. |
| DEVL1? | Examine deviation limit. |

## CONTROL LOOP PARAMETER COMMANDS

The Model EC127 permits the user to modify PID characteristics with these commands. When examining PID coefficients, P, I and D are displayed approximately 3 seconds apart with the value following a P, I and D on control panel display. These commands typically apply to unique circumstances which involve varying loads of mass or radiant power. The PID coefficients are set at the factory for normal operation. If it is necessary to change the default settings SUN can provide a PID Application note containing an instructional overview on how to set the PID coefficients for a particular chamber and load.

| | |
|---|---|
| PID1+= n.nn, n.nn, n.nn | ;Set air Heat PID coefficients P,I, D |
| PID1+? | ;Examine Heat PID coefficients. |
| PID1-= n.nn, n.nn, n.nn | ;Set Cool PID coefficients P, I, D. |
| PIDC? | ;Examine Cool PID coefficients. |
| PWMP=nn | ;Set PWM period (2 to 30 seconds). |
| PWMP? | ;Examine present PWMP value. |

## LOCAL PROGRAM COMMANDS

The Model EC127 provides commands to control the flow of local programs which permit automatic test operation by the chamber. Up to 10 programs may be entered into the controller either from the local control panel or from either the GPIB or RS-232/422 interfaces. Programs may call other programs as subroutines with the GOSUBn instruction. The Model EC127 provides 10 global integer variables designated the letter “I”. The “I” variable may be used in a FOR In/NEXT In statements for multiple pass loops, the “I” variable may be used in IN and OUT instruction for communication with Model EC127 I/O interfaces and it may be used in an arithmetic expressions containing additions and subtractions. The END instruction designates the end of a program or subroutine. And the red END command is used to terminate the edit mode.

A program is entered into the Model EC127 locally from the front panel by using the EDIT m function, where m is the number of the program, 0 thru 9. Programs may be down loaded from a remote interface using the STORE command. Command DELL permits deleting program lines during local edit. DELP m deletes program m, where m is 0 thru 9. A program is executed using the RUN m and prematurely terminated with the STOP command.

Debug assistance and host computer synchronization is provided with the BKPNT nn or BKPNT Im commands, which permit the operator to place breakpoints in the program that suspend program execution until the enter key is depressed on the local control panel or until a remote BKPNTC command is received. BKPNT nn displays the value nn and BKPNT Im displays the value of “Im” when encountered during local prog execution. The remote BKPNT? command is provided so that the host computer may determine the breakpoint value.

```
EDIT m              ;EDIT program m, m=0 thru 9.
RUN m               ;RUN program m, m=0 thru 9.
RUN m TIME=nn       ;RUN program m at time of day
STOP;               ;STOP all program execution.
DELL                ;DELETE LINE currently being displayed during edit mode.
DELP m              ;DELETE PROGRAM m, m=0-9.
BKPNT nnn           ;BREAKPOINT, suspends program operation and display
                    Integer Bkpnt nnn value
BKPNT Im            ;BREAKPOINT, suspends program operation and display current “Im” value

FOR Im[m=0 thru 9]=[starting integer value] , [ending integer value] , [ + / - ]
                    ;FOR statement marks the beginning of a loop.
                     The “Im” variable is either incriminated [+,
                     default] or decremented [-] from the
                     starting integer to the ending integer.
                     FOR statements may be nested 4 deep.

NEXT Im             ;NEXT Im marks the end of the FOR loop.

Im=nnnn             ;Set integer “Im” to 16 bit signed integer value
                     where m=o thru 9, where nnnn=-32767 thru 32768

GOSUB m             ;GOSUB calls a program as a subroutine may be nested 4 deep.
                     where m=0 thru 9
```

END ;End of program statement. Or return if called

LIST #m ;List program “m” to a remote interface.

STORE #m ;Store program “m” from a remote interface.

## MODEL TC01/EC0X COMPATIBILITY COMMANDS

The Model EC127 provides limited upwards compatibility with our Model TC01 temperature controller and our EC0x series environmental chambers as described below. Consult your TC01 manual for a complete definition of these commands.

| | |
|---|---|
| nnn.nC | Set Chamber Temperature (deg C) |
| C | Examine Chamber Temperature (deg C) |
| nnn.nM | Set Time at Temperature, Wait time (minutes) |
| M | Examine Time at Temperature (minutes) |
| T | Examine Chamber Temperature in deg C always |
| nnnUTL | Set Upper Temperature Limit (deg C) |
| UTL | Examine Upper Temperature Limit (deg C) |
| !sss...sss | Transfer String sss...sss received from GPIB to RS-232/422 interface |
| S | Transfer next string received from RS-232/422 interface to GPIB |

## DEVICE I/O COMMANDS

The device I/O commands permit communication from the local control panel or from a host computer to or from the many I/O devices resident in the Model EC127. Consult Section 4 for the proper format of the command for the particular device you wish to communicate with.

| | |
|---|---|
| INj:k,In | Read input port number “j” address “k” into integer variable In |
| In? | read value of integer variable In |
| OUTj:k,l | Write to output port number “j”, address “k”, data “l”. An I variable may also be used in data field |

NOTE: Decimal

## SET DEFAULT MENU (SDEF)

The Model EC127 contains default values which may be tailored to your individual test system requirements. The values are stored in non-volatile memory eliminating the need to reload after a power interruption. The default values may be set locally from the control panel by depressing the SDEF, ENTER keys followed by responding to the menu oriented questions on the control panel display with either a YES or NO response or a numeric value. As you run the menu’s the current settings are shown within parentheses. To keep the current settings and go to the next prompt, just press the enter key. The format of the menu is as follows.

green SDEF then ENTER ;to run Set Default mode.

| | |
|---|---|
| Set Defaults? (Y/N) | Enter Yes or No |
| GPIB Address? (0-30) | Enter GPIB address. |
| GPIB Lockup Time? 0(OFF) 2-59 (5)? | Enter GPIB interface max. lockup time. If Time=0 then GPIB Lock-up interrupts are disabled. |
| Time-out Pre-Time? (0-59 sec.) | Enter GPIB SRQ or Serial Interface early interrupt generation before actual wait period time-out. |
| Power Down Restart? (0-59 min.) | Disables automatic restart of controller above set minutes. |
| D/A Output A? ( 1= 0 to +5V, 2= -5 to +5) | Enter 1 or 2 |
| D/A Output B? ( 1= 0 to +5V, 2= -5 to +5) | Enter 1 or 2 |
| D/A Output C? ( 1= 0 to +5V, 2= -5 to +5) | Enter 1 or 2 |
| D/A Output D? ( 1= 0 to +5V, 2= -5 to +5) | Enter 1 or 2 |
| Serial Port? ( 1=232, 2=422) | Enter 1 or 2 |
| RS CHAR ECHO ON? (Y or N) | Enter Y for serial port character echo. |
| Baud Rate 1=9600 to 6=300 | Enter 1 thru 6 |
| RS DTR/CTS ON (Y/N) | Enter Yes for hardware handshake |
| Buzzer Volume 0=OFF to 3 | Enter 0=OFF, 1=SOFT, 2=MEDIUM, 3=LOUD |
| Chart CH#1 on A? [Yes or No] | Chart chamber probe temperature on D/A output channel A? Enter Yes or No. If entered YES, the controller asks: |
| Enter Low Value | Enter Lowest value to chart in units for this channel |
| Enter High Value | Enter Highest value to chart in units for this channel |
| Chart CH#2 on B? [Yes or No] | Chart user probe on D/A output channel B? Enter Yes or No. If entered YES, the controller asks: |
| Enter Low Value | Enter Lowest value to chart in units for this channel |
| Enter High Value | Enter Highest value to chart in units for this channel |
| +/- CH#1 TRIG? | Enter tolerance at which controller detects that the temperature setpoint is reached. |
| Scan Probe Type 1=K, 2=J, 3=T | For information only, can't change, K type should be default |
| # Enabled (0-8)? (2) | for information only, can't change, 2 should be default |

1 = 9600 BAUD
2 = 4800 BAUD
3 = 2400 BAUD
4 = 1200 BAUD
5 = 600 BAUD
6 = 300 BAUD

## SET INTERRUPT MENU (SINT)

The Model EC127 contains interrupt assignment values for the local alarm, serial interface, and GPIB interface/SRQ interrupt. The values are stored in non-volatile memory eliminating the need to reload after a power interruption. The interrupt values may be set locally from the control panel by depressing the SINT, ENTER keys followed by responding to the menu oriented questions on the control panel display with a YES, NO or numeric response. The format of the menu is as follows.

| | |
|---|---|
| SINT Enter | Enter Set Interrupt mode. |
| Set Interrupts? [Yes/No] | Enter Yes or No |
| BUZZ LP TIMEOUT?[Yes/No] | Enter Y to enable BUZZER after each temperature segment time-out during Local Program execution |
| BUZZ LP Done? [Yes/No] | Enter Y to enable BUZZER when the end of a Local Program is encountered. |
| BUZZ Single T.O.? [Yes/No] | Enter Y to enable BUZZER at the end of each temperature segment time-out in single temp. mode. |
| INT LP TIMEOUT? [Yes/No] | Enter Y to enable Time-out Interrupts after each temperature segment time-out during Local Program execution |
| INT LP Done? [Yes/No] | Enter Y to enable LP Done interrupt when the end of a Local program is encountered. |
| INT SINGLE T.O.? [Yes/No] | Enter Y to enable a Single Temp. Time-out interrupt at the end of each temperature segment in single temp. mode. |
| DEVIATION INT?[Yes/No] | Enter Y to enable DEVIATION Interrupts. |
| CMD ERROR INT'S?[Yes/No] | Enter Y to enable Command Error Interrupts |
| BKPNT INTERRUPT[Yes/No] | Enter Yes to enable breakpoint Interrupts |
| P_POLL(1-8) 0=NO? | Enter 0 to disable parallel poll or 1 thru 8 to set bit position for parallel poll |
| ALL R's INT's OFF [Yes/No] | Enter Yes or No |

Cal Menu ACCESS Code (NUMBER) Enter number 0 to 9

## REMOTE INTERRUPT CHARACTERS

| **Condition** | **Serial Port** | **GPIB Port (HEX)** |
|---|---|---|

| | asyn char | serial poll result |
|---|---|---|
| No Interrupt | (n/a) | $00 |
| Single T.O. INT | I | $41 |
| Command Error INT | CMD ERROR!! | $42 |
| LP Time-out INT | P | $43 |
| LP Done INT | E | $45 |
| DEVIATION INT | D | $46 |
| OVER Temperature INT | O | $47 |
| UNDER Temperature INT | U | $4A |
| GPIB Lock-up INT | (n/a) | $4F |
| POWER Going Down | ! | (none) |
| POWER Up no auto cont. | Z | (none) |
| POWER Up auto cont. | X | (none) |
| BKPNT | B | $50 |

**PROBE CALIBRATION MENU**

For reading the chamber and user probes, the Model EC127 contains two electrically isolated, high performance probe front ends capable of interfacing to a variety of different probe types. This menu permits you to select a probe type, calibrate the probe, and to select the units of measure for each probe. This menu is only used for the chamber and user probes. The type of probes provided by the factory are K type narrow range. Note that the user will probably not need to use this menu for actual probe calibration. Please see cal to a standard calibration commands that follow for user periodic probe calibration.

CAL Enter CAL mode.

NOTE: After CAL is entered the EC127 will display the current types of probes that are connected. Type K from the factory.

CAL Probes? (Y or N) Enter Y if you really want to calibrate probes. Enter N if you only desire to change temperature scale for the CHAMBER and or USER probe.

CAL Chamber Probe? (Y or N) Enter Y to calibrate chamber probe

ENTER CAL ACCESS CODE At this point the menu is asking for an access number to lessen the chance of unauthorized entry into the CAL routine. The default is 9 and can be changed in SINT menu.

.385 RTD? (Y/N) [DIN 43760]
.392 RTD? (Y/N)
J Thermo Narrow? (Y/N)
J Thermo Wide? (Y/N)
K Thermo Narrow? (Y/N)
K Thermo Wide? (Y/N)

Solid State? (Y/N)
Voltage Input (Y/N)
Current Input (Y/N)

if temperature probes was selected

| | |
|---|---|
| Probe at 0C [ ICE WATER]?(Y/N) | set probe to 0 deg C |
| Probe at 100C [ BOILING WATER]?(Y/N) | set probe to 100 deg C |
| Temperature Units? (1=C, 2=F, 3=K) | Enter 1, 2, or 3 |

if voltage or current was selected

| | |
|---|---|
| Low Level Input (Y/N) | supply low level signal to front end |
| Enter Low Value | enter low end process value |
| High Level Input (Y/N) | supply high level signal |
| Enter High Value | enter high end process value |

repeat same process as above for user probe

If a NO answer was given to the “cal probes” prompt, then you are asked if you wish to change the units of measure for each channel.

**CAL TO A STANDARD**

Cal to a standard allows for fine calibration to your in house temperature reference instrument. These CAL commands allow for simple offset and gain adjust to the chamber and user probe readings without requiring removing the probes from the chamber. Unless the type of probe is to be changed, it is recommended that these commands be used when calibration of the chamber or user probe is required. To use these commands, you will need an accurate temperature meter to use as the standard to which you will calibrate the chamber. To perform chamber calibration do the following:

1. Place the probe of your temperature meter in the chamber close to the chamber or user probe that you will be calibrating.

2. Clear any existing cal to standard data by issuing the following command from the front panel; CALCn,9 where n=1 for chamber probe or n=2 for the user probe.

3. Set the chamber to go to the low temperature point for cal point 1. A temperature such as -10 deg C or whatever temperature you wish.

4. Allow 10 minutes for the chamber to stabilize after reaching the set point.

5. Now enter CALAn,9,<temp1> where n=1 for chamber probe or n=2 for the user probe and the <temp1> value is the temperature reading, in current scale units, that your standard meter is reading. At this point you have offset the probes calibration. Next to also do a gain adjustment on the probe you are calibrating do the following.

6. Set the chamber to go to the high temperature cal point 2. A temperature such as 125 deg C or whatever temperature you wish.

7. Allow 10 minutes for the chamber to stabilize after reaching the set point.

8. Now enter CALBn,9,<temp2> where n=1 or 2 and <temp2> is the meter temperature reading in current scale units. Now you have both offset the probe and gain adjusted the probe you are calibrating to match your temperature meter.

## SECTION 4. INPUT/OUTPUT INTERFACES

### AUX ANALOG I/O INTERFACE

The analog I/O interface is useful for interfacing with sensors, instrumentation and control devices. The most common use of the analog output interface is for driving an analog chart recorder. A communication interface may output 8 bit data to up to 4 different channels of analog output designated channel AO_0-3. In addition, a communication interface may read an 8 bit value corresponding to the analog voltage present on up to 3 channels of analog input designated channels AN_1-3. In the SDEF menu, analog output channels may be independently defined as uni-polar with a 0 to +5V output range or bi-polar with a -5V to +5v output range. Analog output channel 3 provides a separate 0 to 20mA current source associated with the voltage output range of 0 to +5V, unipolar. Analog input channels accept a 0 to +5V input. The A/D and D/A data is 0 at low level and 255 at high level. The pin assignments for the analog I/O interface are as follows.

Analog I/O Interface (J2, DB15)

| PIN# | DESCRIPTION |
|---|---|
| 1 | No Connection |
| 2 | AN1 - Analog Input Channel 1 |
| 3 | AN2 - Analog Input Channel 2 |
| 4 | AN3 - Analog Input Channel 3 |
| 5 | AO_0 - Analog Output Channel A |
| 6 | AO_1 - Analog Output Channel B |
| 7 | AO_2 - Analog Output Channel C |
| 8 | AO_3 - Analog Output Channel D |
| 9 | 220 OHM Pull Up Resistor to +12VDC |
| 10,11 | GROUND |
| 12 | -IL3 0-20mA Current Source, -LEAD |
| 13 | +IL3 0-20mA Current Source, +LEAD |
| 14,15 | No connection |

Communication interfaces may read and write data from/to the analog I/O interface by issuing the following instructions.

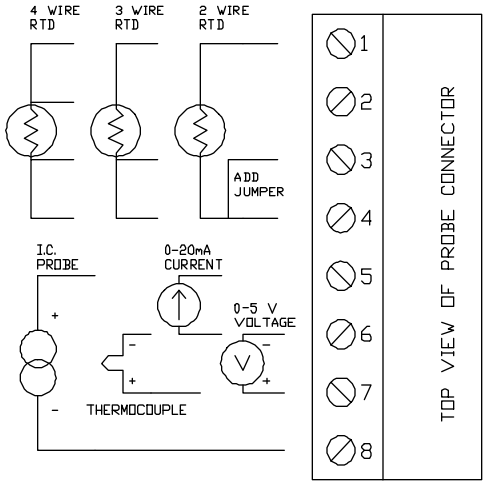
Analog I/O Interface I/O Commands
OUT3:[analog output channel number, 0-3] , [ 0-255]

IN3:[analog input channel number,1-3], Im

## PROBE INTERFACE

The EC127 controller has 4 thermocouple connected to it. Channel 1 is the chamber probe. Channel 2 is the user probe. Channel 3 and Channel 4 probes are used to sense internal temperatures of the refrigeration system. Channel 3 and 4 probes are fixed K type thermocouples and are not user changeable. Channel 1 and 2 probe inputs on the Model EC127 accept several different types of sensors. The type of probe and the calibration for the probe selected is accomplished by running the CAL menu from the local control panel, refer to Section 3. The following represents the connections to the probe connector located inside the controller section for either the Chamber channel or the USER channel.
The factory default probe type is K narrow and most likely you will never have a reason to change the type.

| **PROBE TYPE** | **CONNECTION INFORMATION** |
|---|---|
| 2 WIRE RTD | PIN 1 - RTD OUT, PIN 4 - RTD IN (jump 3 to 4) |
| 3 WIRE RTD | PIN 1 - RTD OUT, PIN 3, 4 - RTD IN |
| 4 WIRE RTD | PIN 1, 2 - RTD OUT, PIN 3, 4 - RTD IN |
| THERMOCOUPLE | PIN 7 - +LEAD, PIN 6 - -LEAD |
| SOLID STATE | PIN 5 - +LEAD, PIN 8 - -LEAD |
| CURRENT(20mA) | PIN 5 - +LEAD, PIN 6 - -LEAD |
| VOLTAGE(+5V) | PIN 7 - +LEAD, PIN 6 - -LEAD |




PROBE/SENSOR CONNECTIONS

**CONNECTION DIAGRAM FOR PROBE/SENSOR**

## SECTION 5. DETAILED COMMAND DESCRIPTIONS

### BKPNT

Function: Local program breakpoint or pause command

Syntax:

| | |
|---|---|
| BKPNTnnn | display number nnn at breakpoint |
| BKPNTIm | display I variable value at breakpoint |

Description:

The breakpoint command allows for local program operation to be suspended until the ENTER key is depressed on the front panel display or until the remote controller issues a BKPNTC command. This command permits program debugging by providing convenient pauses in local program execution such that an operator may examine local program performance and is also useful when a host controller may wish to perform I/O at a point in the local program. One form of the breakpoint command displays a number on the front panel display when encountered which is useful for identifying different breakpoints within a program. The other form of the breakpoint command displays the value of one of the I variables, 0-9, which is useful for breakpoints that are placed within FOR/NEXT loops.

Restrictions:

Breakpoints values displayed on front panel display. To read over remote bus issue BKPNT? command.

See Also:BKPNT?, BKPNTC

Example: editing from the local keyboard

| | |
|---|---|
| EDIT#0« | edit program #0 |
| END | controller response |
| BKPNT100« | set breakpoint 100 |
| END | controller response |
| FOR I2=1,10« | begin FOR/NEXT loop |
| END | controller response |
| BKPNTI2« | set breakpoint for I variable #2 |
| END | controller response |
| NEXTI2« | end FOR/NEXT loop |
| END | controller response |
| END« | terminate program entry |

**BKPNTC**

Function: Remote bus command to continue from breakpoint

Syntax: BKPNTC

Description:

When the BKPNT interrupt is enabled by the SINT menu and a local program is started via a remote RUN command, then when a BKPNT is reached during local program execution the breakpoint interrupt is sent to the appropriate remote bus. The host controller upon receiving the breakpoint interrupt may issue a BKPNT? command to read the value of the breakpoint issue commands and then issue a BKPNTC to continue local program execution.

Restrictions: Remote only command

**BKPNT?**

Function: Remote bus command to read value of breakpoint

Syntax: BKPNT?

Description:

When the BKPNT interrupt is enabled by the SINT menu and a local program is started via a remote RUN command, then when a BKPNT is reached during local program execution the breakpoint interrupt is sent to the appropriate remote bus. The host controller upon receiving the breakpoint interrupt may issue a BKPNT? command to read the value of the breakpoint and issue a BKPNTC to continue local program execution.

Restrictions: Remote only command

**C**

Function: Set or examine the current set temperature in deg C

| Syntax: | nnn.nC | set current set temperature |
|---|---|---|
| | C | examine current set temperature |

Description:

The C command is a TC01 controller compatible command which either sets the current set temperature or examines the controller for the current set temperature. The set or response is in degrees centigrade always. The C command returns with a value of -1999 if the current set temperature is equal to none.

Restrictions: Remote interface command only.

See Also: SET1, SET

| Example: | 150.0C« | Set current set temperature to 150.0 deg C |
|---|---|---|
| | C« | Send command to examine current set temp. |
| | 150.0 | Controller response, temp. = 150 deg C |
| | SET?« | Examine current set temp with SET command |
| | 150.0 | Controller response |

**C1?**

Function: Examine the chamber probe temperature.

Syntax: C1?

Description:

The C1? command permits a remote interface to examine the value of the CHAMBER probe. The units of measure for the chamber probe are set in the CAL menu. Units may be set in °F, °C, or °K. The chamber probe value is normally displayed on the top line of the front panel LCD display.

Restrictions: Remote interface command only.

See Also: C2?, T, TEMP

| Example: | C1?« | examine USER channel probe value |
|---|---|---|
| | 25.0 | controller response, 25.0 units |

**C2?**

Function: Examine the USER probe temperature.

Syntax: C2?

Description:

The C2? command permits a remote interface to examine the value of the USER probe. The units of measure for the USER probe are set in the CAL menu. Units may be set in °F, °C, or °K. The USER probe value is normally displayed on the second line of the front panel LCD display.

Restrictions: Remote interface command only.

See Also: C1?, TEMP

| Example: | C2?« | examine USER channel probe value |
|---|---|---|
| | 25.0 | controller response, 25.0 units |

CAL TO A STANDARD
**CALCn, CALAn, CALBn**

Function: To calibrate the chamber probes to match the readings of an in house temperature standard meter.

| Syntax: | CALCn,9 | Clear existing cal to standard data[ n=1 or 2] |
|---|---|---|
| | CALAn,9,<temp1> | Offset probe n to read <temp1> |
| | CALBn,9,<temp2> | Gain adjust probe n to read <temp2> |

Description:

These three commands are used to perform fine calibration of the chamber and user probes so that their readings will match the reading of an in house temperature meter. First any existing cal data is erased using the CALCn,9 command where n=1 for chamber probe or n=2 for user probe. Then the meters probe is placed in the chamber in close proximity to the probe you wish to calibrate. Then the chamber is instructed to go to temp point #1. After stabilizing at point #1 the CALA command is issued to offset the probe you are calibrating. The chamber is then set to point #2, which should be 50 deg C or more from #1, and by using the CALB command the gain is adjusted for the probe you are calibrating. See cal to a standard section in this manual for an example.

NOTE: Number 9 is the default cal access code. If it is changed then the new access code number will need to be used in this command.

CHANNEL 1 OUTPUT ENABLES
**C1ON+, C1ON-, C1OFF+, C1OFF-**

Function: Disable chamber cooling

Syntax:

| | | |
|---|---|---|
| | C1ON+ | ENABLE AIR HEATING |
| | C1ON- | ENABLE AIR COOLING |
| | C1OFF+ | DISABLE AIR HEATING |
| | C1OFF- | DISABLE AIR COOLING |

Description:

These remote commands permit a remote interface to enable or disable the air heating or cooling functions. Front panel switches are provided for these functions when running the chamber locally. When editing local programs from the front panel keyboard, depressing the switch on the front panel enters its function either ON or OFF. If the opposite action is desired, cancel the entry and re-enter to get the correct action. All local programs default to heat and cool enables ON at the beginning.

Restrictions: None

See Also: CON, COFF, HOFF, HON

Example: C1OFF+« disable chamber heating

CHANNEL 2 COOL BOOST OUTPUT ENABLES
**C2ON-, C2OFF-**

Function: Enables or disables cool boost option

Syntax:

| | | |
|---|---|---|
| | C2ON- | enable cool boost option |
| | C2OFF- | disable cool boost option |

Description:

These remote commands permit a remote interface to enable or disable the cool boost option.

Restrictions: Only operational with optional cool boost feature.

**COFF**

Function: Disable chamber cooling

Syntax: COFF

Description:

The COFF command is an EC1x controller compatable command which permits a remote interface to disable chamber cooling by the controller. The front panel COOL switch also disables controller cool function when depressed if cooling was enabled. When editing local programs from the front panel keyboard, depressing the COOL switch on the front panel ENTERs either CON or COFF. If the opposite action is desired, cancel the entry and re-ENTER to get the correct action. All local programs default to CON at the beginning.

Restrictions: None

See Also: CON, HOFF, HON, C1ON+, C1ON-, C1OFF+, C1OFF-

Example: COFF« disable chamber cooling

**CON**

Function: Enable chamber cooling

Syntax: CON

Description:

The CON command is and EC1x compatible commamd which permits a remote interface to enable chamber cooling operation. The COOL switch located on the front panel can also enable chamber cooling operation if depressed when cooling is disabled. When editing local programs from the front panel keyboard, depressing the COOL switch on the front panel ENTERs either CON or COFF. If the opposite action is desired, cancel the entry and re-ENTER to get the correct action. All local programs default to CON at the beginning.

Restrictions: None

See Also: COFF, HON, HOFF, C1ON+, C1ON-, C1OFF+, C10FF-

Example: CON« Enable chamber cooling operation

**CSET1**

Function: Examine the present control value.

Syntax: CSET1?

Description:

The CSET1 command allows for examining the present value, temperature , that the controller is attempting to control to. During ramping, this value is alternatively displayed on LINE2 of the front panel LCD display.

Restrictions: None

See Also: C1?, TEMP

Example: assumes scale in degrees C

| | |
|---|---|
| RATE1=10« | define temperature segment, RATE1=10°C/m |
| WAIT1=30« | wait=30 min. |
| C1?« | examine present temperature |
| 25.0 | controller response, 25.0°C |
| SET1=35.0« | set new final temperature, 35.0°C |
| | wait 30 seconds |
| CSET1?« | examine present ramp target temperature |
| 30.0 | controller response, 30.0°C |

**DELL**

Function: Delete current line during local program edit

Syntax: DELL

Description:

The delete line (DELL) command allows for deleting program lines during local program editing on the front panel keyboard. The line currently displayed will be deleted when the DELL command is entered.

Restrictions: Local front panel command only

See Also: DELP

Example:

| | |
|---|---|
| EDIT#2« | edit local program #2 |
| GOSUB#0 | controller response, first line of LP |
| [DOWN-ARROW] | use up/down arrows for scrolling LP |
| BKPNT1 | controller response |
| DELL« | delete breakpoint command |
| GOSUB#5 | controller response, next line of program |

**DELP**

Function: Delete or clear local program

Syntax: DELPm or DELP#m

Description:

The delete program command allows for deleting, which in this case is the same as clearing, a single local program defined by the variable “m”, where m is in the range of 0 to 9. Programs may be deleted either from the local front panel or from a remote interface. Before using the STORE command from a remote interface, the local program selected, 0 thru 9, must be deleted if any commands are present in that particular local program.

Restrictions: None

See Also: DELL, STORE

Example: from a remote interface

| | |
|---|---|
| DELP#0« | clear local program #0 |
| STORE#0« | prepare controller for accepting commands |
| *** | send local program commands |
| END« | terminate local program down load |

**DEVL1**

Function: Set or examine the deviation limit

| Syntax: | | |
|---|---|---|
| | DEVL1=nnn.n | Set deviation limit |
| | DEVL1? | Examine deviation limit |

Description:

The DEVL1 command sets the deviation limits for the chamber probe. If the deviation limit interrupt is enabled in the SINT menu and the chamber probe temperature varies by more than the set limit, an interrupt will be generated to the active remote interface.

Restrictions: Deviation Limit range is between 0.1 and 300.

See Also: UPL1, LOL1, UTL, LTL, SINT Menu

| Example: | | |
|---|---|---|
| | if SCALE#1=C | |
| | DEVL1=2.5« | set deviation limit to 2.5°C |
| | DEVL1?« | examine deviation limit |
| | 2.5 | controller response, 2.5°C |
| | RATE1=30« | define temp. segment |
| | WAIT1=03:00:00« | wait for 3 hours |
| | SET1=-55.0« | set final temp. to -55.0°C |

**EDIT**

Function: Edit local program from the local keyboard.

Syntax: EDITm or EDIT#m

Description:

The EDIT command allows for local program loading and editing from the local keyboard. A local program, specified by m in the range of 0 to 9, may be edited by using the up and down arrows, delete line (DELL) command or by entering new commands which are placed in front of the command presently displayed on the front panel LCD display. Local program editing is terminated by entering the END command.

Restrictions: Local keyboard command only.

See Also: STORE, LIST, END

Example: This example illustrates entering and editing a local program from the front panel keyboard. The local program consists of a call to LP#2, a breakpoint which displays the number 1, and a call to LP#5.

| | |
|---|---|
| EDIT#0« | edit local prog. #0 |
| END | controller response on LCD display |
| GOSUB#2« | enter prog. call to local prog #2 |
| END | controller response |
| GOSUB#5« | enter prog. call to local prog #5 |
| END | controller response |
| [UP ARROW]« | scroll up |
| GOSUB#5 | controller response |
| BKPNT1« | insert breakpoint between calls<br>to LP#2 and LP#5 |
| GOSUB#5 | controller response |
| END« | enter end local program editing command |

**END**

Function: Terminate local program editing or
remote local program downloading.

Syntax: END [LP]

Description:

The END command terminates program editing when editing local programs from the local keyboard and terminates remote program downloading when using the STORE command from a remote host computer.

Restrictions: None

See Also: EDIT, STORE

Example: This example illustrates entering a local program from the front panel keyboard. The local program consists of a call to LP#2, a breakpoint which displays the number 1, and a call to LP#5.

| | |
|---|---|
| EDIT#0« | edit local prog. #0 |
| END | controller response on LCD display |
| GOSUB#2« | enter prog. call to local prog #2 |
| END | controller response |
| BKPNT1« | enter breakpoint between calls to LP#2 and LP#5 |
| END | controller response |
| GOSUB#5« | enter prog. call to local prog #5 |
| END | controller response |
| END« | end local program editing |

**FOR/NEXT**

Function: Loop definition command for local programming

Syntax:
FOR Im = <Beginning Value>,<Ending Value> or
FOR Im = <Beginning Value>,<Ending Value>, + or
FOR Im = <Beginning Value>,<Ending Value>, -
NEXT Im

Description:

The FOR/NEXT loop command provides looping capability for local program operation. Commands contained within the boundaries between the FOR statement and the NEXT statement are repeated as defined by the FOR statement. The beginning or ending value may be any integer value or an I variable value. The FOR/NEXT loop either increments the beginning value until the beginning value is equal to or greater than the ending value or decrements the beginning value, when the minus option is used, until the beginning value is equal to or less than the ending value. The number of loop executions is equal to the absolute value of the ending value minus the beginning value. Without regard to the beginning and ending values, the loop is always executed one time. FOR/NEXT loops may be nested four deep when considering the first loop as nest#1.

Restrictions: None

See Also: GOSUB

Example:

| | |
|---|---|
| DELP#2 | clear program #2 |
| STORE#2 | load local program #2 |
| FOR I5=1,5« | FOR I variable #5, step 1,2,3,4 |
| FOR I2=5,I5,-« | FOR I variable #2, 5, I variable #5, dec |
| | step 5,4,3,2 (Pass 1) |
| | step 5,4,3 (Pass 2) |
| | step 5,4 (Pass 3) |
| | step 5 (Pass 4) |
| BKPNT I2« | set breakpoint, display I variable #2 |
| NEXT I2« | end FOR/NEXT nest #2 |
| NEXT I5« | end FOR/NEXT nest #1 |
| END« | end program store |
| RUN#2 | run program #2 |

When the program is run, the breakpoint value will display the step sequence for the FOR/ NEXT I2 variable loop.

**GOSUB**

Function: Execute local program “m” as a subroutine

Syntax: GOSUBm or GOSUB#m

Description:

The GOSUB command allows local programs to be called by other local programs as sub-routines. At the end of a local program called by a GOSUB command, execution commences at the command following the GOSUB command in the calling program. Nesting is supported for four levels of nesting considering the top level program as nest#1. I variables are global to all local programs.

Restrictions: None

See Also: FOR/NEXT

Example: if program already loaded and operating remotely

```
LIST#2«          display local program #2
FOR I3=0,10      set FOR/NEXT for 10 cycles
GOSUB#0          execute program in LP#0
GOSUB#1          execute program in LP#1
NEXTI3           end FOR/NEXT loop for I variable #3
END              end of LP#2
```

**HOFF**

Function: Disable chamber heating

Syntax: HOFF

Description:

The HOFF command is an EC1x compatible command which permits a remote interface to disable chamber heating by the controller. The front panel HEAT switch also disables controller heat function when depressed if heat was enabled. When editing local programs from the front panel keyboard, depressing the HEAT switch on the front panel ENTERs either HON or HOFF. If the opposite action is desired, cancel the entry and re-ENTER to get the correct action. All local programs default to HON at the beginning.

Restrictions: None

See Also: CON, COFF, HON, C1ON+, C1ON-, C1OFF+, C1OFF-

Example: HOFF« disable chamber heating

**HON**

Function: Enable chamber heating

Syntax: HON

Description:

The HON command is an EC1x compatible command which permits a remote interface to enable chamber heating operation. The HEAT switch located on the front panel can also enable chamber heating operation if depressed when heating is disabled. When editing local programs from the front panel keyboard, depressing the HEAT switch on the front panel ENTERs either HON or HOFF. If the opposite action is desired, cancel the entry and re-ENTER to get the correct action. All local programs default to HON at the beginning.

Restrictions: None

See Also: COFF, CON, HOFF, C1ON+, C1ON-, C1OFF+, C1OFF-

Example: HON« Enable chamber heating operation

## I VARIABLES

Function: Set or examine I variables.

| Syntax: | | |
|---|---|---|
| | Im= <value> | set Im equal to value |
| | Im= Im + <value> | set Im equal to sum of values |
| | Im= Im - <value> | set Im = to difference of values |
| | Im? | examine I variable m |

Description:

I variables are used in local programs for loop control and general purpose Integer arithmetic. A value may be any integer in the range of + 32768/-32767 or another I variable. The controller supports 10 I variables, where "m" ranges from 0 to 9. I variables are global between all local programs and as such, care should be taken to insure that the same I variable is not used in two different applications within any active group of local programs.

Restrictions: None

See Also: FOR/NEXT, IN, OUT, BKPNT

| Example: | | |
|---|---|---|
| | I0=52« | set I variable #0 to 52 |
| | I2=I0« | set I variable #2 equal to I variable #0 |
| | I5=I0-9« | set I var.#5 = I var.#0- 9 = 43 |
| | I6=I0+I5« | set I var.#6 = I var.#0 + I var.#5 = 95 |
| | I6?« | examine I variable #6 |
| | 95 | controller response |

## IN

Function: Input data from the AUX port, USER bus, SPI port, or A/D port

Syntax: IN<device number>:<address>,Im

Description:

The IN command allows data read capability from the analog port. Data values read are stored in a I variable. For proper operation of the device interface consult the appropriate section describing the device in full.

Restrictions: None

See Also: OUT, I variables

| Example: | | |
|---|---|---|
| | IN3:2,I2 | Read A/D channel 2 into I var.#2 |

**LIST**

Function: List a local program from a remote interface

Syntax: LISTm or LIST#m

Description:

The LIST command permits a remote interface to upload a local program from the controller. This command allows a remote operator to verify the results of a STORE instruction, which downloads programs to the controller. In addition, some communication programs allow for capturing data to text files. In this manner, local programs can be maintained on a personal computer and down loaded or uploaded if required.

Restrictions: Remote interface command only

See Also: STORE

Example:

| | |
|---|---|
| DELP#0« | clear local program #0 |
| STORE#0« | ready controller for local program down load |
| *** | send local program |
| END« | end down load |
| LIST#0« | request upload of LP#0 |
| *** | local program displayed |

**LLO**

Function: RS-232/422 Command to lockout local keyboard

Syntax: LLO

Description:

The Local Lockout (LLO) command may be issued from a host processor to lockout the local keyboard. The LLO command only applies to host computers communicating over the RS-232 or RS-422 serial interfaces. Local keyboard function may be unlocked thru the use of the RTL command. Local keyboard lockout operation for host processors communicating over the IEEE-488 interface is bus interface command. The syntax varies according to the particular host computer.

Restrictions: RS-232/422 remote interface command only. Each host GPIB interface uses unique syntax for local lockout commands.

See Also: RTL

Example:

| | |
|---|---|
| LLO« | lockout local keyboard run sensitive testing |
| RTL« | unlock local keyboard |

**LOL1**

Function: Set or examine the lower temperature limit

| Syntax: | LOL1=nnn.n | Set lower limit |
|---|---|---|
| | LOL1? | Examine lower limit |

Description:

The LOL1 command allows for setting the lower temperature limit which is the lowest temperature valve that the controller will accept as a setpoint. If the chamber probe temperature should ever go below the LOL1 setting, the cool enable will be turned off automatically. An interrupt will also be generated if enabled.

Restrictions: Temperature values for the LOL1 command must range between -50°C and the UPL1 setting.

See Also: UPL1, UTL, LTL

| Example: | If scale is set to °C | |
|---|---|---|
| | LOL1=-20.0« | set LOL1 to -20°C |
| | LOL1?« | examine LOL1 |
| | -20.0 | controller response, -20°C |

**LTL**

Function: Set or examine the lower temperature limit

| Syntax: | LTL=nnn.n[u] | Set LTL, where u=variable units (ºC, ºF, ºK) |
|---|---|---|
| | LTL? | Examine LTL, default units |

Description:

The LTL command is an EC1x compatible command which allows for setting the lower temperature limit which the controller will attempt to control. The units for the LTL command are those as selected in the CAL menu for the chamber probe or the optional u units. The optional u units can be accepted remotely only and will be converted automatically to default units.

Restrictions: Temperature values for the LTL command must range between -200°C and the UTL setting.

See Also: UTL, UPL1, LOL1

| Example: | If scale is set to °C | |
|---|---|---|
| | LTL=-100.0« | set LTL to -100°C |
| | LTL?« | examine LTL |
| | -100.0 | controller response, -100°C |

**M**

Function: Set or examine the current wait at temperature time.

| Syntax: | nnn.nM | Set the temperature segment wait time |
|---|---|---|
| | M | Examine the current temperature wait time |

Description:

The M command is a TC01 controller compatible command which either sets the current temperature segment wait time, sometimes referred as soak period, or allows a remote interface to examine the current setting. When setting wait times, nnn.n represents the wait time in minutes. If wait time is equal to forever, M returns 19999.

Restrictions: Remote command only.

See Also: WAIT1, WAIT

| Example: | 12.1M« | Set wait time for 12.1 minutes |
|---|---|---|
| | M« | Examine wait time |
| | 12.1 | Response from controller |
| | WAIT1?« | Examine wait time with WAIT command |
| | 00:12:06 | Response from controller |

**OFF**

Function: Turn off chamber power

Syntax: OFF

Description:

The OFF command turns off the power to the chamber. As long as the chamber is connected to an appropriate line voltage, the controller in the chamber is still power on. The OFF command turns off the front panel display, indicators and switch functions, except for the POWER switch. In addition, commands received over the remote interfaces are ignored except for the ON command. Depressing the POWER switch when the chamber is ON results in the same function as the OFF command.

Restrictions: Remote interface command only

See Also: ON

| Example: | OFF« | Turn OFF chamber |
|---|---|---|

**ON**

Function: Turn on power to chamber

Syntax: ON

Description:

The ON command enables power and function of the chamber. When the chamber is plugged in to an appropriate line voltage the controller is powered on and can accept a power on command from either the front panel by depressing the power switch or from a remote interface by using the ON command.

Restrictions: Remote interface command only

See Also: OFF

Example: ON« Turn on chamber power

**OUT**

Function: Output data to the AUX port, USER bus, SPI port, or A/D port

Syntax: OUT<device number>:<address>,<data>

Description:

The OUT command permits data to be transferred to an output device such as the digital to analog convertors. For a complete description on operating with an I/O device, consult the particular device section.

Restrictions: None

See Also: IN

Example: OUT<device number>:<address>, <data>
where device number of ANALOG PORT is 3.
where address of ANALOG PORT is a channel # 0 to 3
where data of ANALOG PORT is a base ten number, from 0 to 255.
The A/D to D/A data is 0 at low level and 255 at high level.

OUT3:c,x where c is channel 0,1,2 or 3
where x is base ten number from 0 to 255.
The A/D to D/A is 0 low level and 255 at high level.

when x=0 represents 0v for 0v to 5v output range
low level represents -5v for -5v to +5v output range
represents 0mA for 0mA to 20mA output range

when x=255 represents 5v for 0v to 5v output range
high level represents +5v for -5v to +5v output range
represents 20mA for 0mA to 20mA output range

Note: The unit will accept a data value larger than 255 (ie. 0 = low value, 255 = high value, 256 = low value, 511 = high value, 512 = low value etc...)

In order for the OUT3 command to work properly in a local program, you must use an integer value from 0 - 255. Assuming a 0 - 5V analog output range, to obtain the integer value you need to produce the correct voltage, you must divide the desired voltage by 5V and multiply this result by 255. (Vint = Vx/5 *255). To obtain 1V, (1/5*255=51) you would issue the command: OUT3:2,51 and to produce 5V you would issue the command OUT3:2,255 (5/5*255=255).

Formulas to determine decimal numbers from 0 - 255 to provide desired voltage:

For 0 - 5V Range:
ie V = 0V, x = 0
V = 5V, x = 255

$$x = \left(\frac{\text{V desired}}{5}\right) \times (255)$$

For 0 - 20mA Range:
ie I = 0mA, x = 0
I = 20mA, x = 255

$$x = \left(\frac{\text{I desired}}{20}\right) \times (255)$$

For -5V - +5V Range:
ie V = -5V, x = 0
V = +5V, x = 255

$$x = \left(\frac{\text{V desired}}{10}\right) \times (255)$$

**PID1-**

Function: Set or examine PID coefficients for air cool control

| Syntax: | | |
|---|---|---|
| | PID1-=nnn.n,nnn.n,nnn.n | set cool PID coefficients |
| | PID1-? | examine cool PID coefficients |

Description:

The PID1- command permits modification and examination of the proportional, integral and derivative (PID) coefficients used in the algorithm which controls the chamber cooling process. PID coefficients may be changed to accommodate varying changes in mass or radiant power in the test chamber area. PID coefficients are stored in battery backed memory. The default PID coefficients will most likely not need to be changed.

Restrictions: None

See Also: PID1+

| Example: | | |
|---|---|---|
| | PID1-=0.25,0.001,0.1« | set PID coefficients |
| | PID1-?« | examine PID coefficients |
| | 0.25 | controller response, P |
| | 0.001 | controller response, I |
| | 0.1 | controller response, D |

**PID1+**

Function: Set or examine PID coefficients for heat control

| Syntax: | | |
|---|---|---|
| | PID1+=nnn.n,nnn.n,nnn.n | set heat PID coefficients |
| | PID1+?« | examine heat PID coefficients |

Description:

The PID1+ command permits modification and examination of the proportional, integral and derivative (PID) coefficients used in the algorithm which controls the chamber heating process. PID coefficients may be changed to accommodate varying changes in mass or radiant power in the test chamber area. PID coefficients are stored in battery backed memory. The default PID coefficients will most likely not need to be changed.

Restrictions: None

See Also: PID1-

| Example: | | |
|---|---|---|
| | PID1+=0.25,0.001,0.1« | set PID coefficients |
| | PID1+?« | examine PID coefficients |
| | 0.25 | controller response, P |
| | 0.001 | controller response, I |
| | 0.1 | controller response, D |

**PIDA**

Function: To place the chamber in an advanced temperature control mode

| | | |
|---|---|---|
| Syntax: | PIDA=n | where n=0 for normal control to chamber probe |
| | | where n=1 for control to average of cham and user |
| | | where n=3 for control to user probe |

Description:

The PIDA command is used to select one of the advanced PID control modes. When PIDA=0 is set the controller uses the readings from the chamber probe for control. Mode 0 is the default mode. Mode 1 uses the average of the chamber and the user probe temperatures as the control. Mode 3 uses the user probe reading for control. Care must be used when using mode 1 or 3 since if the user probe is attached to a large thermal mass it may lag the chamber probe air temperature. If the user probe temperature lags the air temperature by a large amount, the air temperature may hit the UPL1 or LOL1 and thus force off heat or cool.

**RATE1**

| | | |
|---|---|---|
| Function: | Set the current rate of change for ramping | |
| Syntax: | RATE1=nnn.n | Set the current ramping rate |
| | RATE1? | Examine the current ramping rate |

Description:

The RATE1 command allows for setting or examining the rate at which the controller will control the change from one setpoint to another setpoint within the chamber. Rate is based on the chamber probe and on the current units temperature SCALE1. When setting or examining the rate, nnn.n represents units per minute. Units may be °F, °C, or °K.

Restrictions: Chamber dynamics limit the maximum ramping rate.

See Also: SET1, WAIT1, RATE, SET, WAIT

Example: If SCALE1 for the chamber probe is in °C

| | |
|---|---|
| RATE1=10.0« | set ramping rate for 10.0°C/minute |
| RATE1?« | examine present ramping rate |
| 10.0 | controller response, 10.0°C/min. |
| C1?« | read present chamber probe temperature |
| 25.0 | controller response, for example 25.0°C |
| SET1=35.0« | set new setpoint, for example 35°C after waiting 30 seconds |
| C1?« | read present chamber temperature |
| 30.0 | controller response, up 5°C in one half min. |

**RATE**

Function: Set the current rate of change for ramping

| Syntax: | | |
|---|---|---|
| | RATE=nnn.n[u] | Set the current ramping rate |
| | RATE? | Examine the current ramping rate |

Description:

The RATE command is an EC1x compatible command which allows for setting or examining the rate at which the controller will control the change from one setpoint to another setpoint within the chamber. Rate is based on the chamber probe and on the units of SCALE set up for the chamber probe in the CAL menu or optional u units. When setting or examining the rate, nnn.n represents units per minute.

Restrictions: Chamber dynamics limit the maximum ramping rate.

See Also: SET, WAIT, RATE1, SET1, WAIT1

Example: If SCALE for the chamber probe is in °C

| | |
|---|---|
| RATE=10.0« | set ramping rate for 10.0°C/minute |
| RATE?« | examine present ramping rate |
| 10.0 | controller response, 10.0°C/min. |
| TEMP?« | read present chamber temperature |
| 25.0 | controller response, for example 25.0°C |
| SET=35.0« | set new setpoint, for example 35°C |
| | after waiting 30 seconds |
| TEMP?« | read present chamber temperature |
| 30.0 | controller response, up 5°C in one half min. |

**RTL**

Function: RS-232/422 Command to unlock local keyboard

Syntax: RTL

Description:

The Return to Local (RTL) command may be issued from a host processor to unlock the local keyboard. The RTL command only applies to host computers communicating over the RS-232 or RS-422 serial interfaces. Local keyboard function may be locked thru the use of the LLO command. Local keyboard unlock operation for host processors communicating over the IEEE-488 interface varies according to the particular host computer syntax requirements.

Restrictions: RS-232/422 remote interface command only. GPIB interface host computers use the IEEE-488 return to local command.

See Also: LLO

Example:

| | | |
|---|---|---|
| | LLO« | lockout local keyboard run sensitive testing |
| | RTL« | unlock local keyboard |

**RUN**

Function: Starts the execution of a local program

Syntax: RUNm or RUN#m

Description:

The RUN command initiates the execution of local program defined by m, where m selects a local program in the range of 0 to 9. Local programs are entered into the controller using the EDIT command from the local keyboard or down loaded from a remote host computer using the STORE command. Local program execution may be prematurely terminated by issuing a STOP command.

Restrictions: None

See Also: RUN-TIME, EDIT, STOP, STORE, END

Example: This example downloads a simple program from remote processor and then executes the program. Scale in °C.

| | |
|---|---|
| DELP#0« | delete current program 0 |
| STORE#0« | prepare controller for entering local prog. |
| FOR I2=0,10« | set FOR loop for 10 loops |
| RATE1=10« | define temp. segment 1, RATE1=10°C/m |
| WAIT1=15« | wait = 15 minutes |
| SET1=-55.0« | set final temp to -55.0°C |
| SET1=125.0« | define temp. segment 2, rate=10°C/m |
| | wait=15 minutes, final temp = +125.0°C |
| NEXT I2« | mark end of FOR loop, I2 |
| END« | mark end of local prog. and end of STORE |
| RUN#0« | run local prog. 0 |

**RUN-TIME OF DAY**

Function: Starts the execution of a local program at a specific time of day.

Syntax: RUNmTIME=hh:mm:ss or RUN#mTIME=hh:mm:ss

Description:

The RUN-TIME command initiates the execution of local program defined by m, where m selects a local program in the range of 0 to 9, at a specific time of day. Local programs are entered into the controller using the EDIT command from the local keyboard or down loaded from a remote host computer using the STORE command. Local program execution may be prematurely terminated by issuing a STOP command.

Restrictions: None

See Also: RUN, EDIT, STOP, STORE, LIST, END

Example: This program lists the current program in local program 0 from a remote interface and then prepares for executing the program at 5:00 PM.

| | |
|---|---|
| LIST#0« | list local program 0 |
| | controller response: |
| FOR I2=0,10 | set FOR loop for 10 loops |
| RATE1=10 | define temp. segment 1, RATE1=10°C/m |
| WAIT1=15 | wait = 15 minutes |
| SET1=-55.0 | set final temp to -55.0°C |
| SET1=125.0 | define temp. segment 2, rate=10°C/m |
| | wait=15 minutes, final temp = +125.0°C |
| NEXT I2 | mark end of FOR loop, I2 |
| END | mark end of local prog. and end of STORE |
| | |
| RUN#0TIME=17:00:00« | run local prog. 0 at 5:00 PM |

**S/!**

Function: Transmit and receive ASCII data from the GPIB to the RS-232/422 Serial Interface.

| Syntax: | !sss...sss | transmit string sss...sss to the serial intf. |
|---|---|---|
| | S | receive string from serial interface. |

Description:

The S/! command is a TC01 compatible command which allows the GPIB interface to transmit ASCII data to the RS-232/422 serial interface or receive data from the serial interface. Care should be taken that a serial device does not transmit data to the controller until an S command has been issued, since, data received from a serial device without an S command pending will be interpreted as command data for the chamber controller. An S command is required for each string of characters, terminated with a carriage return and/or line feed, to be transferred to the GPIB interface. GPIB lock-up time is inhibited for the S command to allow time for a serial device to respond to a prompt message.

Restrictions: GPIB remote interface command only.

See Also: n/a

Example: these commands must originate from the GPIB interface

| | |
|---|---|
| S« | GPIB interface sends request for reply prior to sending a prompt message to insure that the reply message is sent to the GPIB interface by the controller. |
| !send status« | the string “send status” is sent from the controllers serial interface to prompt serial interface device. |
| I’m OK | controller response, transfers message received from serial interface to the GPIB interface. |

**SCALE1**

Function: Examine present scale for the chamber or user probes

Syntax:

| | |
|---|---|
| SCALE#1? | examine chamber probe scale |
| SCALE#2 | examine user probe scale |

Description:

The SCALE command allows a remote interface to examine the present scale of units for the chamber or user probe. The scale of units for the two probes are set in the CAL menu. Temperature units may be C, F, or K.

Restrictions: Remote interface command only

See Also: CAL Menu

Example:

| | |
|---|---|
| SCALE#1?« | examine chamber probe scale |
| C | controller response, degrees Centigrade |
| SCALE#2?« | examine USER probe scale |
| F | controller response, degrees F |

**SDEF**

Function: Set or examine the EC127 defaults

Syntax:

| | |
|---|---|
| SDEF | to run SDEF menu from front panel |
| SDEF=aaaaaaan | a=Y,N,1 or 0; n=0 to 3 |
| SDEF? | |

Description:

When you wish to setup all EC127 default parameters then you must enter SDEF from the front panel to enter the set defaults menu. The menu operation is covered in Section 3 of this manual under SDEF MENU. When controlling the EC127 via a remote host computer the SDEF= and SDEF? commands can be used to read and change selected EC127 default parameters. When the SDEF? command is received the EC127 sends an 8 character string to the active remote port. To modify the available default parameters the remote host sends SDEF=aaaaaaan where character position:

| | |
|---|---|
| 1; [Y/N] | Y=dual loop control mode |
| 2; [Y/N] | Y=RS char echo on |
| 3; [Y/N] | Y=chart C1 on D/A A |
| 4; [Y/N] | Y=chart C2 on D/A B |
| 5; [Y/N] | Y=optional printer on |
| 6; [Y/N] | Y=PID #1 to D/A C |
| 7; [Y/N] | Y=PID #2 to D/A D |
| 8; 0 to 3 | buzzer volume (0=off) |

Note; For front panel entry into local programs, a 1 may be used in leu of a Y and a 0 rather than a N.

Restrictions: Remote command or local front panel menu. The SDEF= command may be stored in LP to modify on the fly.

**SET1**

Function: Set or examine temperature segment final temperature

Syntax:

| | |
|---|---|
| SET1=nnn.n | Set segment final temperature |
| SET1? | Examine segment final temperature |

Description:

The SET1 command allows for setting or examining the final temperature within a temperature segment. The temperature segment consists of the change of temperature, defined by the RATE1 command, from the chamber present temperature to the temperature defined by the SET1 command, plus the time specified by the WAIT1 command to soak at the temperature defined by the SET1 command. The units accepted by the SET1 command are those chosen in the probe CAL menu. For best results a temperature segment should be entered as RATE1, WAIT1 then SET1.

Restrictions: The value set by the SET1 command must range between the values set for the LOL1 and UPL1 commands.

See Also: RATE1, WAIT1, LOL1, UPL1, SET, RATE, WAIT

Example: If SCALE for the chamber probe is in °C

| | |
|---|---|
| RATE1=10.0« | set ramping rate for 10.0°C/minute |
| WAIT1=5 | set wait = 5 minutes |
| C1?« | read present chamber temperature |
| 25.0 | controller response, for example 25.0°C |
| SET1=35.0« | set new setpoint, for example 35°C |
| SET1? | examine present set temp. |
| 35.0 | controller response |
| | after waiting 30 seconds |
| C1?« | read present chamber temperature |
| 30.0 | controller response, up 5°C in one half min. |

**SINT**

Function: Set or examine the set interrupt parameters

Syntax: SINT=xxxxxxxxxxn Sets SINT parameters
where x is Y or N character
where n is a digit from 0 to 8

SINT? Examines the SINT parameters by returning an 11 character string where position

1; Y=all remote serial RS port interrupts off
2; Y=single timeout interrupt enabled
3; Y=deviation interrupt enabled
4; Y=Local Program (LP) timeout interrupt enabled
5; Y=Local Program (LP) done interrupt enabled
6; Y=buzz single timeout
7; Y=buzz Local Program (LP) done
8; Y=buzz Local Program (LP) timeout
9; Y=command error interrupt enabled
10; Y=BKPNT interrupt enabled
11; 0= no parallel pole . or bit 1 to 8

Note: When ENTERing from the front panel a 1 may be used for Y and 0 for N.

Description:

The SINT command allows for setting or examining the set interrupt parameters over the GPIB, RS232 or RS422.

Restrictions: Remote command only

See Also: See Set Interrupt Menu, in Section 3 of this manual

Example: SINT=NYYYYNNNYY0
where position
1; N=all remote interrupts ARE NOT off
2; Y=single timeout interrupt enabled
3; Y=deviation interrupt enabled
4; Y=Local Program (LP) timeout interrupt enabled
5; Y=Local Program (LP) done interrupt enabled
6; N=buzz single timeout disabled
7; N=buzz Local Program (LP) done disabled
8; N=buzz Local Program (LP) timeout disabled
9; Y=command error interrupt enabled
10; Y=BKPNT interrupt enabled
11; 0= no parallel pole
1 to 8 to define parallel pole bit

**STATUS?**

Function: To poll the EC127 status

Syntax: STATUS?

Description:

The status inquiry command is a remote bus command that allows the host control computer to poll the EC127 to determine its current operating status. When the STATUS? command is received the EC127 sends back a 26 character string of Y's or N's where character position:

| | |
|---|---|
| 1; [Y/N] | Y=power on |
| 2; [Y/N] | Y=cmd error last command |
| 3; [Y/N] | Y=time out LED is on |
| 4; [Y/N] | Y=waiting for WAIT1 timeout |
| 5; [Y/N] | Y=C1+ is enables (heat enable) |
| 6; [Y/N] | Y=C1- is enabled (cool enable) |
| 7; [Y/N] | Y=valid SET1 has been entered |
| 8; [Y/N] | Y=waiting for WAIT2 timeout |
| 9; [Y/N] | Y=C2+ is enabled |
| 10; [Y/N] | Y=C2- is enabled |
| 11; [Y/N] | Y=valid SET2 has been entered |
| 12; [Y/N] | Y=DEVL1 exceeded |
| 13; [Y/N] | Y=C1 is ramping |
| 14; [Y/N] | Y=DEVL2 exceeded |
| 15; [Y/N] | Y=C2 is ramping |
| 16; [Y/N] | Y=C1<LOL1 |
| 17; [Y/N] | Y=C1>UPL1 |
| 18; [Y/N] | Y=C2<LOL2 |
| 19; [Y/N] | Y=C2>UPL2 |
| 20; [Y/N] | Y=waiting at a BKPNT |
| 21; [Y/N] | Y=in LP run mode |
| 22; [Y/N] | Y=in LP remote store mode |
| 23; [Y/N] | Y=in local LP edit mode |
| 24; [Y/N] | Y=waiting to run LP at TOD |
| 25; [Y/N] | Y=GPIB bus timeout |
| 26; [Y/N] | Y=in local lockout |

Restrictions: Remote only, read only, not stored in LP

**STOP**

Function: Terminate local program execution and single temperature segment execution.

Syntax: STOP

Description:

If in Local Program operation, the STOP command terminates local program execution in the controller. If running in single temperature mode, then entering the STOP command terminates the temperature segment and sets SET=NONE and WAIT=FOREVER.

Restrictions: None

See Also: RUN

Example:

| | |
|---|---|
| DELP#0« | clear LP area #0 |
| STORE#0« | ready controller for accepting LP commands |
| *** | send LP commands |
| END« | terminate store operation |
| LIST#0« | display local program |
| *** | controller displays local program |
| RUN#0« | execute local program |
| *** | |
| STOP« | terminate local program activity |

**STOPE9**

Function: To perform a reset of controller software.

Syntax: STOP key, E key, 9 key or STOPE9

Description:

The STOPE9 command will restore SDEF and SINT parameters to factory default settings, clear all local programs, and initialize all controller variables and data structures. This command does not modify the sensor calibration data. This command is a software reboot command and is useful if you suspect that the controller is not functioning properly. After issuing this command the controller will go to power off. When power is turned on a RAM ERROR message is normal.

**CAUTION:** All local programs will be erased!

**STORE**

Function: Stores a down loaded local program from a remote interface

Syntax: STOREm or STORE#m

Description:

The STORE command allows a remote interface to down load a local program to the controllers local memory, where “m” identifies one of ten possible local program areas, 0 thru 9. Once down loaded, local programs may be executed by issuing a RUN command. Prior to downloading a program to the controller, the local program must be cleared by using the DELP command. Local programs can be displayed or uploaded by using the LIST command.

Restrictions: Remote interface command only.

See Also: LIST, RUN, DELP, STOP

Example:

| | |
|---|---|
| DELP#0« | clear LP area #0 |
| STORE#0« | ready controller for accepting LP commands |
| *** | send LP commands |
| END« | terminate store operation |
| LIST#0« | display local program |
| *** | controller displays local program |
| RUN#0« | execute local program |
| *** | |
| STOP« | terminate local program activity |

**T**

Function: Examine current chamber temperature in °C

Syntax: T

Description:

The T command is a TC01 controller compatible command which examines the present temperature associated with the chamber probe. The response is always in degrees centigrade.

Restrictions: Remote interface command only.

See Also: TEMP?, C1?

| Example: | | |
|---|---|---|
| | SET=25.0« | Set current set temperature to 25°C |
| | | After ramp period ended |
| | T« | Examine current chamber temperature |
| | 25.1 | Actual chamber temperature returned |
| | TEMP?« | Examine current chamber temperature |
| | 25.1 | Actual chamber temperature returned |

**TEMP**

Function: Examine current chamber temperature

Syntax: TEMP?

Description:

The TEMP command is an EC1x command which provides the means for a remote interface to read the present value of the chamber probe. This value is normally displayed on the first line of the front panel LCD display. The units for the chamber probe are set in the CAL menu for °F, °C, or °K.

Restrictions: Remote Interface command only.

See Also: T, C1?

| Example: | | |
|---|---|---|
| | TEMP?« | read chamber probe |
| | 25.0 | controller response, 25.0 units |

**TIME**

Function: Set or examine time of day

Syntax: TIME=hh:mm:ss set time of day
TIME? examine present time of day

Description:
The TIME command is useful for documenting report outputs and for starting local programs at a specific time of day. Time is entered and displayed in a 24 hour format, i.e., hours (hh) range from 00 to 23; minutes (mm) range from 00 to 59 and; seconds (ss) range from 00 to 59.

Restrictions: None

See Also: RUN#mTIME=hh:mm:ss

Example: TIME=13:30:00« set time to 1:30 PM
TIME?« examine time of day
13:30:00 controller response

**TIMEE?**

Function: Reads the accumulated elapsed time in hours that the chamber has been running

Syntax: TIMEE? examine accumulated elapsed hours

Description:
The TIMEE? command is an EC1x compatible command which keeps track of the amount of time (in hours) that the chamber has been running. The elapsed time is saved in EEROM to protect against RAM memory loss. The time is updated whenever the unit is turned off or when a TIMEE? command is received and at least one hour has elapsed since the last update.

Restrictions: None

Example: TIMEE? examine elapsed hours
+32.37 controller response is 32.37 Hours

**UPL1**

Function: Set or examine the upper temperature limit

Syntax:

| | | |
|---|---|---|
| | UPL1=nnn.n | set the high temperature limit [205 max] |
| | UPL1? | to see what upper limit is set for |

Description:

The UPL1 command allows setting the upper limit in current chamber probe scale that a set temperature can be set. If an attempt is made to set a temperature above the UPL1 limit, a command error will result. If the chamber temperature should exceed the UPL1 setting the heat enable will be turned off, thus disabling further heating. An interrupt will be also generated if enabled.

See Also: LOL1, UTL, LTL

**UTL**

Function: Set or examine the upper temperature limit

Syntax:

| | | |
|---|---|---|
| | nnn.nUTL | TC01 compatible set UTL in °C |
| | UTL | TC01 compatible examine UTL in °C |
| | UTL=nnn.n[u] | Set UTL, variable units |
| | UTL? | Examine UTL, variable units |

Description:

The TC01 compatible commands provide for setting and examining the UTL in degrees centigrade only. If temperature units are desired to be the same as that set in the CAL menu for the SCALE variable, then the UTL=nnn.n and UTL? command formats should be used. If the chamber temperature exceeds the UTL setting, then an over temperature interrupt will be generated to the active remote interface and the heat output will be disabled.

Restrictions: TC01 compatible commands operate from the remote interface only.

See Also: LTL, UPL1, LOL1

Example: If scale is set to °F

| | |
|---|---|
| 150.0UTL« | set UTL to 150°C |
| UTL« | examine UTL in °C |
| 150.0 | controller response, 150.0°C |
| UTL?« | examine UTL in units of SCALE, °F |
| 302.0 | controller response, 302°F |

**VER?**

Function: Examine the version number of the software in the controller

Syntax: VER?

Description:

The VER? command is an EC1x compatible command which allows the user to check the version of software that the EC127 chamber is running. Version 1.06 and up will also display on the front panel when the unit is turned on.

Restrictions: RS232/422 remote interface command only.

See Also: Version number will also appear at the back of the first page of your EC127 user manual.

Example: VER?

**WAIT1**

Function: Set or examine the temperature segment wait period

| Syntax: | | |
|---|---|---|
| | WAIT1=hh:mm:ss | set wait in hours:minutes:seconds |
| | WAIT1=mm | set wait in minutes only (mm=00 to 59) |
| | WAIT1=F(OREVER) | set WAIT to forever |
| | WAIT1? | examine current wait setting |

Description:

For most testing applications it is necessary to control temperature to a set point and after reaching the set point stay there for some period of time. The WAIT1 command determines the time that the controller will maintain the set temperature after the set temperature reached is within the value specified in "+/- AT SET TRIGGER" variable in the SDEF menu. Once the wait period begins, the wait time continues regardless of changes in chamber temperature. When running a local program, the next command in the program is executed after the wait period is timed out. In single temperature mode, the controller generates time-out indication then continues to maintain the set temperature after the wait period time-out. During the wait period, examination of WAIT1 returns the time remaining in the wait period. After the end of a wait time-out, the WAIT1 is reset to forever. For best operation the temperature segment should be entered RATE1, SET1 then Wait1.

Restrictions: Range from 99:59:59 to 00:00:01

See Also: SET1, RATE1, M, SET, RATE, WAIT

| Example: | | |
|---|---|---|
| | RATE1=10« | define temperature segment, rate=10°C/min |
| | WAIT1=00:10:30« | wait=10 min, 30 sec |
| | C1?« | examine current chamber probe temperature |
| | 25.0 | controller response, 25.0°C |
| | SET1=35.0« | set new temperature, 35°C |
| | | after 1 minute, set temperature is reached, wait period begins; after 1 more minute, |
| | WAIT1?« | examine wait setting |
| | 00:09:30 | controller response, 9 min, 30 sec remaining |

**WAIT**

Function: Set or examine the temperature segment wait period

| Syntax: | | |
|---|---|---|
| | WAIT=hh:mm:ss | set wait in hours:minutes:seconds |
| | WAIT=mm | set wait in minutes only (mm=00 to 59) |
| | WAIT=F[OREVER] | set WAIT to forever |
| | WAIT? | examine current wait setting |

Description:

The WAIT command provides timing for the length of time the controller has maintained the set temperature. The "+/- AT SET TRIGGER" variable in the SDEF menu determines when timing is started. Once the wait period begins, the wait time continues regardless of changes in chamber temperature. When running a local program, the next command in the program is executed after the wait period has timed out. In single temperature mode, the controller continues to maintain the set temperature after the wait period timeout. During the wait period, examination of WAIT returns the time remaining in the wait period. After the end of a wait time-out, the WAIT is reset to forever. For best operation the temperature segment should be ENTERed RATE, WAIT then SET.

Restrictions: Range from 99:59:59 to 00:00:01

See Also: SET, RATE, M, WAIT1, SET1, RATE1

| Example: | | |
|---|---|---|
| | RATE=10« | define temperature segment, rate=10°C/min |
| | WAIT=00:10:30« | wait=10 min, 30 sec |
| | TEMP?« | examine current chamber temperature |
| | 25.0 | controller response, 25.0°C |
| | SET=35.0« | set new temperature, 35°C |
| | | after 1 minute, set temperature is reached, wait period begins; after 1 more minute, |
| | WAIT?« | examine wait setting |
| | 00:09:30 | controller response, 9 min, 30 sec remaining |

## SECTION 6. EC127 OPTIONS

### POWER OPTIONS

The EC127 can be manufactured to operate from a 115 Volt AC 60 HZ or 220 Volt AC 50 HZ power line. The chamber requires a full 15 AMP service. The EC127 should be the only device running on a 15 AMP branch and if an extension cord is used it must be a 14 Gauge, or larger, 3 conductor cord.

### COOLING OPTIONS

The EC127 is cooled by a built in environmentally safe closed loop refrigeration system. The refrigeration system is powered by a one third horse power hermetically sealed compressor. The system uses safe R404a refrigerant. For special situations where the cooling speed needs to be increased LCO2 or LN2 boost injection cooling options can be ordered with the chamber. See COOL BOOST (LCO2 and LN2) heading in Section 3.

### $N_2$ GAS PURGE OPTION (No Needle Valve)

When the product you are testing requires a dry nitrogen environment, to prevent water condensation or oxidation, the nitrogen gas purge option is useful. This option provides access to purge $N_2$ gas into the chamber through an 1/8" NPT nipple located on the back of the chamber.

### PORT AND WINDOW OPTIONS

Standard port and door options are available at the time of order. Standard options include 1", 2", 3" and 4" diameter round feed through ports that can be mounted in the door and/or sides of the chamber. Hinged or a pull off door can be ordered as well as a window door. Please call with your special requirements.

## SECTION 7. SPECIFICATIONS

| | |
|---|---|
| Chamber Volume | 2.7 cu ft |
| Internal Dim | 20" W x 12" H x 19" D |
| Temperature Range | -30 to 200 C |
| With Cool Boost Option | -40 to 200 C |
| Temp Resolution | 0.02 deg |
| User Probe | Yes |
| Battery Backup | Yes |
| IEEE-488 Bus | Yes |
| RS232 Bus | Yes |
| RS422 Bus | Yes |
| Max Rate of Change (without boost) | 5.0 C / minute |
| Airflow CFM Vertical | 300 cu ft/min |
| Power Req | 1500 Watts |
| Shipping Weight | 120 lbs |

SAFETY:

| | |
|---|---|
| Probe Malfunction | Open / Short Probe Detection |
| Controller Malfunction | Hardware Watch Dog Timer |
| Temperature limits | Upper and Lower software limits and Adjustable Thermostat |

## SECTION 8. MAINTENANCE

The EC127 chamber was designed to require minimal maintenance. The only two areas that require attention are the following. First keep the air inlet at the inner chamber evaporator coil clean and unobstructed. Secondly to periodically clean the refrigeration condenser coil that is located in the bottom compartment.

### INNER CHAMBER AIR CIRCULATION EVAPORATOR CLEANING

The inner chamber evaporator must be kept clean and unobstructed to allow proper air flow circulation inside the chamber. To clean the evaporator, pick out any foreign material that may have lodged in the evaporator coil fins. Then use low pressure shop air to blow away small particles when necessary.

### REFRIGERATION SYSTEM CONDENSER CLEANING

The refrigeration systems condensing coil is located in the chamber bottom section left side. A cooling fan blows room air over the condensing coil and the compressor to cool them. If dust collects on the condensing coil, heat transfer from the coil can be reduced thus causing loss of refrigeration efficiency. Therefore periodic cleaning of the condenser is recommended. How often the condenser needs to be cleaned will be a function of how dusty your area, where the chamber is being used, is. The chamber controller monitors the compressor temperature during operation. If the compressor temperature over heats the controller will automatically shut the compressor off for 3 minutes and display a E5 error message on the front panel LCD for 10 seconds. The E5 overtemp error may be caused by a dirty condenser or obstructed cooling airflow. To clean the condenser coil perform the following steps.

1. Unplug the chamber from the power line.

2. Remove the left side outer chamber panel to gain access to the coil that is located in the bottom compartment left side.

3. Using a low pressure shop air hose, blow dust off condenser coil and out of the chamber compartment.

4. Replace side panel.

## SECTION 9. CHAMBER REPAIR

### TEMPERATURE CONTROLLER SECTION REMOVAL AND REPLACEMENT

The temperature controller section is located on the bottom of the chamber front. The controller electronics is located in a pull out drawer for easy access. Follow the procedure outlined below for the removal and replacement of the controller section.

STEP 1 Remove all electrical power from the chamber, unplug the chamber from the line voltage. Insure that all of the components of the chamber have reached ambient temperature.

STEP 2 Remove chamber right side panel

STEP 3 Remove screws located on controller front bottom edge and screws on left edge that go through chamber left side panel.

STEP 4 Carefully slide controller drawer out far enough to gain access to the connectors.

STEP 5 First unplug the three green probe connectors and the in-line molex 5 pin plug.

STEP 6 Disconnect the 26 pin flat cable from the I/O board that is mounted on the chamber floor right side. Also unplug the 2 wire power input cable from the I/O board. The controller electronics is now free to be removed.

REPLACEMENT Reverse steps 1-5

### HEATER ELEMENT REMOVAL AND REPLACEMENT

The heating elements are located behind the air baffle located inside the test chamber area. Follow the procedure below for removal and replacement.

STEP 1 Unplug the chamber from the line voltage. Insure that the heating elements and the interior of the chamber have had time to reach ambient temperature.

REMOVE AIR BAFFLE

STEP 2 Remove the (2) 6-32 screws located at the top of the evaporator cover.

STEP 3 Remove the (2) 6-32 screws located on the ceiling of the test chamber that hold the air baffle.

REMOVE CHAMBER BACK PLATE

STEP 4 Remove the #6 screws located on the perimeter of the chamber back plate and remove back.

HEATER ELEMENT REMOVAL

STEP 5 Carefully remove the fiberglass insulation from the heater mounting area. Remove the 6-32 nut and flat washer from each side of the heater element. Remove the wired ring terminals from the heater element mounts.

STEP 6 Remove the next 6-32 nut and beveled washer from both mounting sides.

NOTE: When re-installing, always place the wide part of the bevel washer towards the ceramic insulator. Tighten the nut finger tight plus 3/4 of a turn or use 4 inch pounds of torque.

REPLACEMENT- Defective heater elements are replaced with new ceramic insulators and new heater element. Reverse steps 5 and 6 for installation

## FAILSAFE THERMOSTAT REMOVAL AND REPLACEMENT

The failsafe thermostat is located internally on the rear of the chamber. If replacement of the failsafe is deemed necessary, follow the procedure below.

STEP 1 Unplug the chamber from the line voltage. Insure that the interior of the chamber has had time to reach ambient temperature.

REMOVE CHAMBER BACK PLATE

STEP 2 Remove the #6 screws located on the perimeter of the chamber back plate and carefully remove back.

STEP 3 Remove the fiberglass insulation which covers the failsafe thermostat. Locate the thermostat and disconnect the (2) wires attached inline to the thermostat utilizing quick disconnect terminals.

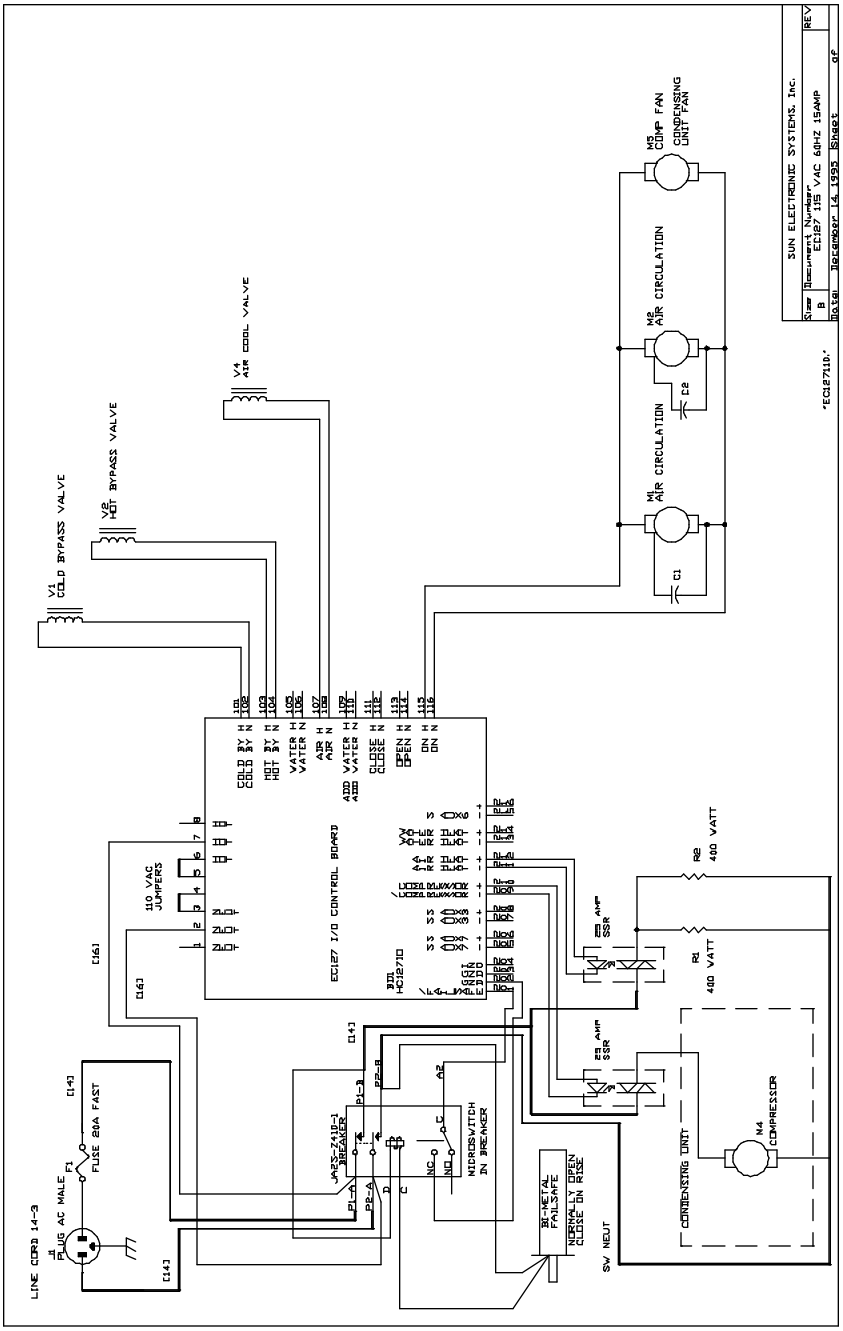
STEP 4 Remove the (3) #6 screws which hold the thermostat to the rear wall of the test chamber and remove the thermostat.

REPLACEMENT Reverse steps 2 thru 4. Calibrate the thermostat under the procedures described in section 2 of this manual.

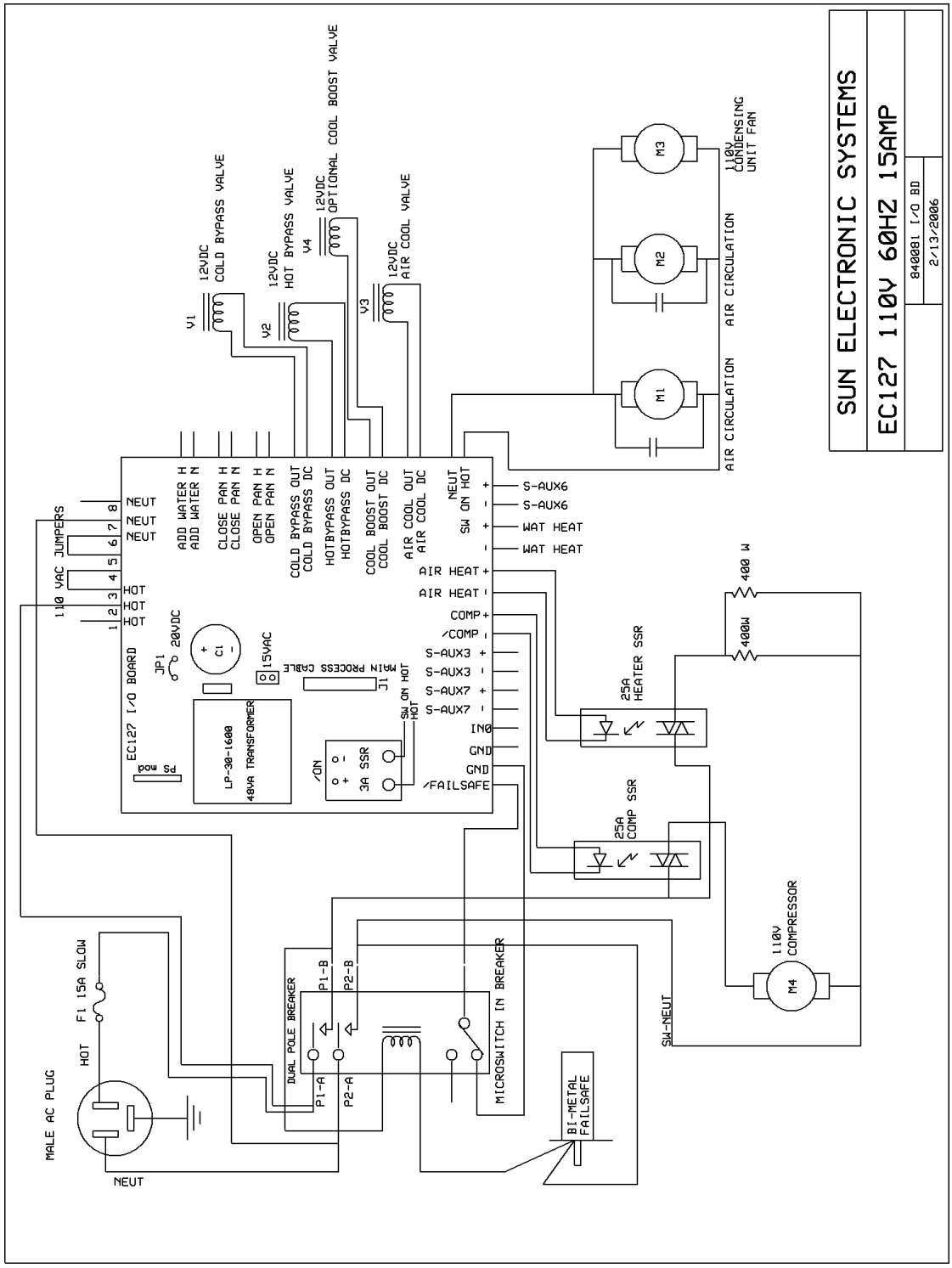
## REFRIGERATION SYSTEM CHARGING

The refrigeration system in the EC127 chamber uses one pound of R404a [HP62] environmentally safe refrigerant. The compressor uses POE oil. NOTE: for the warranty to remain valid any service to the refrigeration system must be performed by a service person recognized by Sun Systems. To assess the refrigeration condensing unit, remove the left side chamber cover. Once the left side cover is removed, you will see the suction service valve and high side service valve. The suction service valve is the one nearest the rear panel. To be sure of the charge, reclaim any refrigerant in the system, then slowly fill one pound of R404a into the system. The charging is done with the compressor not running by charging into the high side.

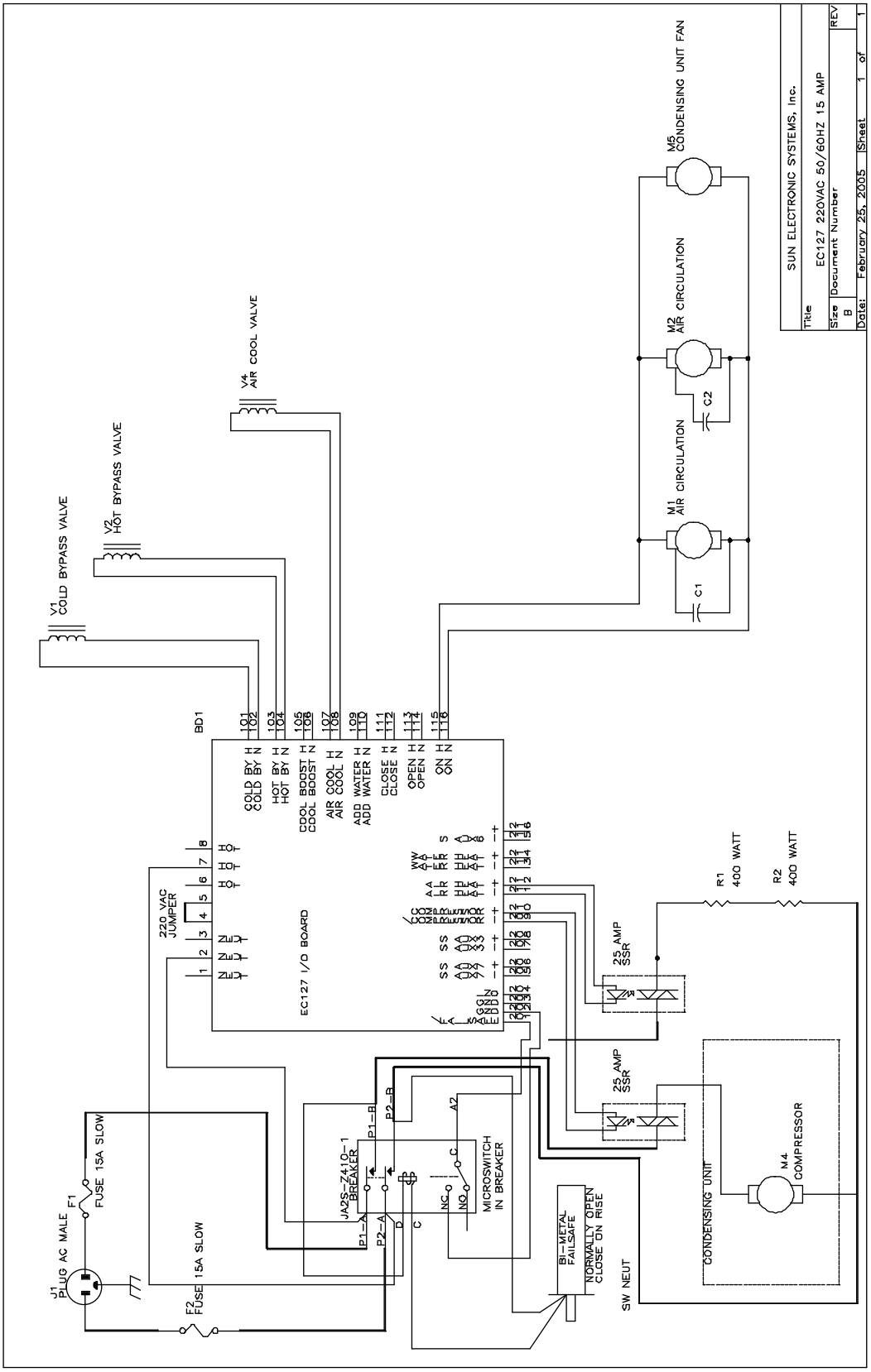
# 110 $V_{AC}$ 3 WIRE SCHEMATIC WITH $V_{AC}$ COOL VALVE



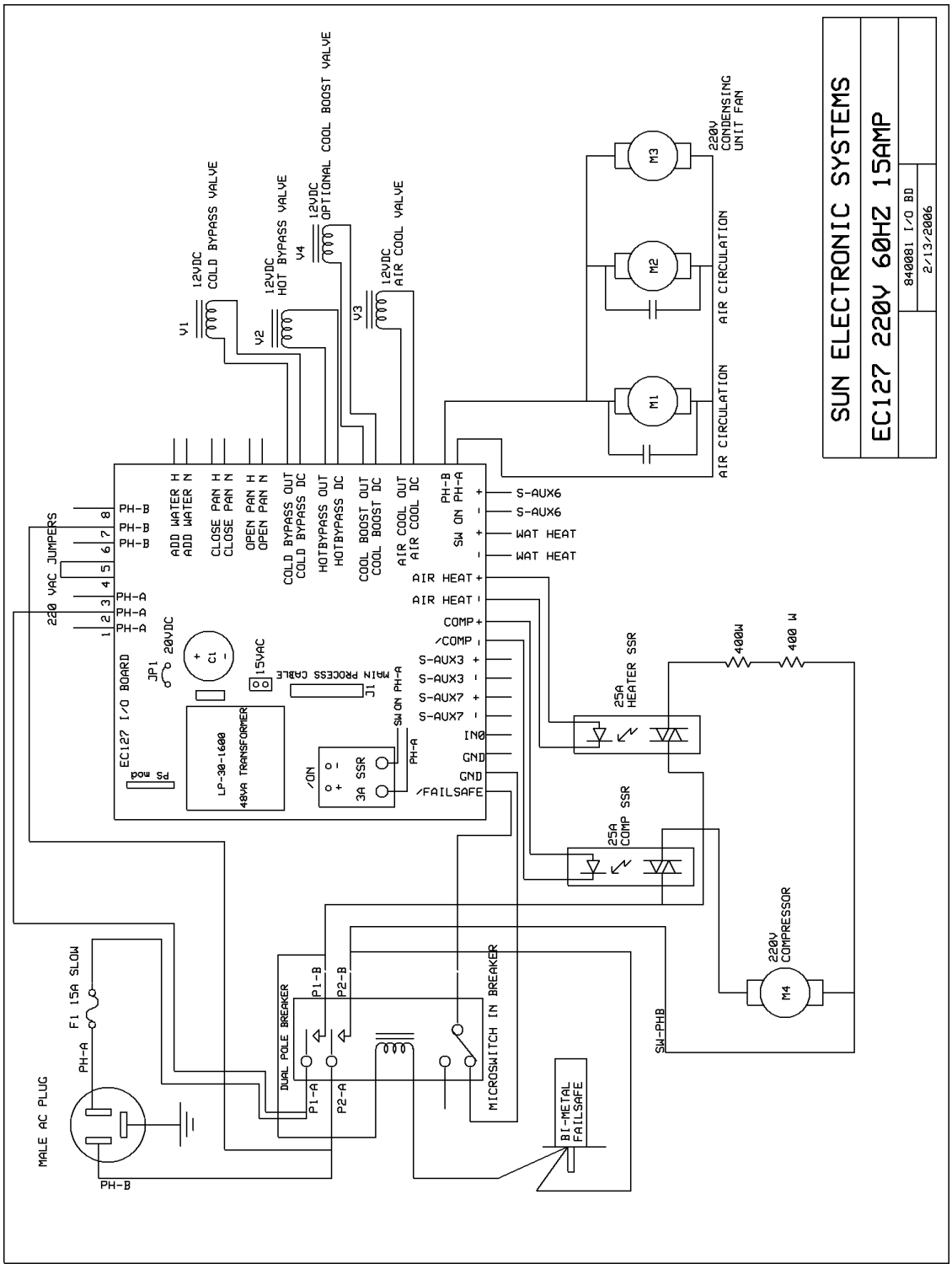
# 110 $V_{AC}$ 3 WIRE SCHEMATIC WITH $V_{DC}$ COOL VALVE



# 220 $V_{AC}$ 3 WIRE SCHEMATIC WITH $V_{AC}$ COOL VALVE



# 220 $V_{AC}$ 3 WIRE SCHEMATIC WITH $V_{DC}$ COOL VALVE



## SECTION 10. REPLACEMENT PARTS

| | |
|---|---|
| BI-METAL FAILSAFE | 800008 |
| FAILSAFE BREAKER | 650010 |
| TYPE K CHAM PROBE<br>TYPE K USER PROBE | |
| 400 WATT 110 VAC HEATER ELEMENT | 980200 |
| DOOR HANDLE ASSEMBLY, RIGHT | 980502 |
| DOOR HANDLE ASSEMBLY, LEFT | 980501 |

## SECTION 11. ERROR MESSAGES

### REFRIGERATION SYSTEM ERROR MESSAGES

The EC127 controller will display an En [n=1 to 6] error message, on the front panel display, if it detects an abnormal condition in the refrigeration system. The error message is displayed for 10 seconds then goes away. The controller will not start or will turn off the refrigeration system when an error is found. If the chamber is not cooling properly, watch the display for an error indication then call factory for assistance. The following error messages may occur.

E1 A valve not opening.

E2 A valve not opening.

E3 A valve not closing.

E4 A valve not closing.

E5 Compressor motor overtemp. Clean to allow airflow.

E6 Low refrigerant charge. System has leak or sensor bad.

### PROBE ERROR MESSAGES

The EC127 controller will display the following error messages if probe faults are detected. Watch the display for an error indication, then call factory for assistance.

| | |
|---|---|
| Probe #1 Error | Fault with chamber probe detected. |
| Probe #2 Error | Fault with user probe detected. |
| Probe #3 - #4 Error | Fault with Scanner Probes detected. |
| Probe #5 - #10 Error | Incorrect number of scanner probes have been enabled. In Set Default Menu (SDEF), scroll down to "# Enabled" and select (2). |

### SRQ OVERFLOW

This message is to inform the user that interrupts have not been read by the host computer. This mesage can be ignored if you do not wish to provide an interrupt handler in your host software. For further information, refer to Section 3, **GPIB (IEEE-488) Parallel Interface.**